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Board Composition and Corporate Governance Mechanisms: Evidence from Chinese Listed Central Enterprises

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Board Composition and Corporate Governance Mechanisms: Evidence from Chinese Listed Central Enterprises

Xin Geng

A thesis submitted for the degree of Doctor of Philosophy

University of Bath

School of Management

April 2020

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Abstract

The Chinese stock market is characterised by a high proportion of state-owned enterprises (hereafter called SOEs). To improve their performance and competitiveness, the Chinese government has implemented a series of SOE reforms since 1978. One of the main tasks of the SOE reforms has been to create a modern enterprise system. However, the existing literature provides limited and mixed evidence on the effectiveness of corporate governance mechanisms among listed SOEs (e.g. Huyghebaert and Wang, 2012; Ke et al., 2012; Reddy and Yu, 2014; Liu et al., 2015).

The listed central enterprises (hereafter called listed CEs) are the leading enterprises among listed SOEs, as they are generally large in size and in important or monopoly industries related to the national security of the country. In addition, they are more politically sensitive, as they are ultimately controlled by the central enterprises that are solely owned by the central government. In other words, the central government is the ultimate owner of listed CEs. In this thesis, the effectiveness of corporate governance mechanisms among listed CEs is investigated, with the focus being on three aspects: the affiliated directors that are nominated from the central enterprise or its affiliations, the independent directors on the corporate board, and the supervisory board.

After controlling for the potential endogeneity issue and conducting multiple robustness checks, first it is found that the significant deviation of the control and cash-flow rights motivates central enterprises to appoint more affiliated directors on the corporate board in the next period. Also, the proportion of affiliated directors has an inverse U-shaped relation to the subsequent firm value of listed CEs. This result implies that too many affiliated directors on the corporate board lead to lower firm value in the next period among listed CEs. This research also involves examining the contemporaneous relationship between affiliated directors and firm value in listed CEs and it is concluded that these two factors jointly affect each other.

Second, it emerges that the independent director system is an effective mechanism for improving the investment efficiency of listed CEs, i.e. when more than 47.3% of directors on the corporate board are independent. In addition, it is elicited that the U-shaped relationship between the proportion of independent directors and investment efficiency is a unique phenomenon among listed CEs by conducting a PSM (propensity score matching) approach. This study also involves extending the test into over- and under-investment scenarios and the result is that the aforementioned relationship is only presented in listed CEs with over-investment issues. This indicates that the independent director system plays a more efficient role in reducing investment inefficiency caused by over-investment problems.

Last, this research identifies that a large supervisory board, older supervisors, and more than three female supervisors on the supervisory board can improve the financial reporting quality of listed CEs. Affiliated supervisors from the central enterprise or its affiliations and significant age diversity of the supervisory team have a negative effect on financial reporting quality among listed CEs. Moreover, employee representatives on the supervisory board and the average compensation of the supervisory board have no significant impact on the financial reporting quality of listed CEs.

The findings are important in the context of the existing literature. This research is one of the few contemporary studies examining the influence of the central government as the ultimate owner and the effectiveness of corporate governance mechanisms among a specific kind of SOE, which has a tight connection with the central government.

Acknowledgement

I would like to take this opportunity to thank all the people who support me to finish my PhD. First and foremost, my special gratitude goes to my PhD supervisor, Dr Daisy Chou. I do not think I can accomplish the PhD study without her support, leadership, patience and guidance. Her wisdom and rigorous academic attitude inspired me with my research. Also, her understanding and encouragement helped me come over one difficult time after another during the past four years. For me, her role is not only limited to a teacher, but also a friend and a great mentor in life.

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Last, I would like to give great thanks to my parents for their unconditional supports and love. Their greatest understanding motivated me to finish my PhD study.

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List of Abbreviations

CAPM: Capital Assets Pricing Model

CEO: Chief Executive Officer

CPC: Communist Party of China

CSMAR: Chinese Securities Market and Accounting Research

CSRC: China Securities Regulatory Commission

FE: Fixed Effect

GDP: Gross Domestic Product

HEI: High Education Institution

IPO: Initial Public Offering

IV: Instrumental Variable

IV-GMM: Instrumental Variable – Generalised Method of Moments

Listed CE: Listed Central Enterprise

NPC: National People's Congress

OLS: Ordinary Least Squares

PPE: Property, Plant, and Equipment

PSM: Propensity Score Matching

SASAC: State-owned Assets Supervision and Administration Commission

SOE: State-owned Enterprise

VIF: Variance Inflation Factor

2SLS: Two-stage Least Squares

3SLS: Three-stage Least Squares

Chapter 1 Introduction

1.1 Introduction

The Chinese stock market is characterised by a high proportion of state-owned enterprises (SOEs) (Wang and Xiao, 2009; Szamosszegi and Kyle, 2011; Leung and Cheng, 2013), which have played an important role in the development of the country. SOEs in China have experienced significant reforms since 1978. Creating a modern enterprise system has been one of the main tasks of SOE reforms, as the government believes that advanced and efficient corporate governance mechanisms can improve their performance and competitiveness (Chen and Lau, 2000; Huang, 2018). The effectiveness of corporate governance mechanisms in listed SOEs has been widely debated in recent years, with mixed related empirical evidence. For instance, Liu et al. (2015) document that board independence can improve firm operating performance in listed SOEs. However, Ke et al. (2012) find that the effect of independent directors on improving investment efficiency is less significant than that in listed non-SOEs. Huyghebaert and Wang (2012) argue that directors affiliated with the ultimate owner enlarge the minority-investor expropriation (measured by related-party transactions) among listed SOEs. The listed central enterprises (listed CEs) are a special kind of listed SOE, which have a closer political connection with the central government. This is because the listed CEs are ultimately controlled by the central enterprises that are wholly owned by the central government and administered by the State-owned Assets Supervision and Administration Commission (SASAC), a ministry of the central government. In addition, the listed CEs generally are concentrated in important or monopoly sectors that the central government would like to keep under its absolute control, such as defence, energy, and the shipping industries.

The performance of corporate governance mechanisms is considered to be different in listed CEs and listed local SOEs, as the central and local governments have different

motivations and take different actions in managing them[1] (Wang and Xiao, 2009; Cheung et al., 2010; Leung and Cheng, 2013; Reddy and Yu, 2014). However, there is little study of listed CEs and the influence of the central government as the ultimate owner. This makes exploring the effectiveness of the corporate governance mechanisms among listed CEs and investigating the impact and the power of the ultimate owner to listed CEs a worthwhile endeavour. Accordingly, this thesis conducts three independent empirical studies related to the corporate governance mechanisms of listed CEs: (1) the determinants of affiliated directors from the central enterprise or its affiliations on the corporate board and their economic consequences, (2) the relationship between independent directors on the corporate board and investment efficiency, and (3) the relationship between the characteristics of the supervisory board and financial reporting quality.

The remainder of the chapter is structured in the following manner. Section 1.2 introduces the objectives of this thesis and defines the scope of the investigation. Section 1.3 discusses the significance and contributions to the literature. Section 1.4 outlines the structure of this thesis.

1.2 Research scope and objectives

The first objective of this thesis is to investigate the influence of the ultimate owner (the central government) on the board structure measured by the proportion of affiliated directors on the corporate board. Besides the ownership structure, the board of directors is an important channel for ultimate owners to control the listed firms. For listed CEs, the central enterprises may appoint affiliated directors on the corporate board due to different incentives. The first study discusses explicitly how the central enterprises affect the board composition of listed CEs through the ownership (i.e. the control rights and the cash-flow rights owned by the central government). In addition, the literature suggests that the

[1] See Reddy and Yu (2014), which provides a detailed discussion about the difference in incentives and actions between the central and local governments for managing SOEs. For instance, the central government cares more about enhancing its own objectives by providing a helping hand to listed CEs (e.g. policy support) (Cheung et al., 2010). However, listed local SOEs are the instrument for generating revenue (Mattlin, 2009). Local governments have a strong incentive to expropriate the wealth of minority shareholders when they have difficult budgetary constraints or revenue inducement (Hassard et al., 2010).

characteristics of the corporate board may influence the proportion of affiliated directors as well. Hence, this research controls for a range of factors relating to the board characteristics. Moreover, this study investigates the economic consequences of affiliated directors, especially their impact on the firm value of listed CEs. In line with the literature, Tobin's Q is the proxy for the firm value of listed CEs. Also, this study involves examining whether other corporate governance mechanisms (the external audit and the foreign investor) influence the relationship between affiliated directors and firm value as well as the effect of the excess board seats controlled by the ultimate owner on the firm value of listed CEs.

The second objective of this thesis is to examine the function of independent directors among listed CEs. The Chinese government introduced the independent director system in 2001 and the China Securities Regulatory Commission (CSRC) holds that the primary duty of independent directors is to protect the interests of minority shareholders. Given that a high proportion of the state shares is involved among listed CEs, there is a significant conflict of interest between the controlling shareholders (i.e. the central enterprises on behalf of the central government) and individual investors. The social and political goals of the government potentially lead to inefficient investments that may impact negatively on the wealth of the minority shareholders. The board of directors takes the decision-making role. The independent directors can participate in the investment decisions of listed CEs, so that they can protect the interests of minority shareholders directly. Hence, the second study examines whether a higher proportion of independent directors can improve the investment efficiency of listed CEs. Besides the proportion of independent directors on the corporate board, there is further investigation into whether the board attendance as well as the gender and age diversity of independent directors are drivers for improving investment efficiency. Last, this study examines whether extra control from the ultimate owner (i.e. the central enterprises on behalf of the central government) affects the relationship between independent directors and investment efficiency.

The last objective of this thesis is to investigate the effect of the supervisory board among listed CEs. There are two systems that have the monitoring function in the Chinese corporate governance structure, one being the independent director system, whilst the

other is the supervisory board. Compared with independent directors, the supervisors focus on monitoring the financial affairs of firms rather than participating in the decision-making process. Hence, the third study investigates how the supervisory board affects the financial reporting quality of listed CEs. Particularly, this study examines the effect of supervisory board size, board composition (affiliated supervisors and employee representatives), supervisor characteristics (average age and diversity of gender and age), and board incentives on financial reporting quality, respectively. In addition, the influence of the ultimate owner and the size effect on the relationship between affiliated supervisors (employee representatives) on financial reporting quality, are considered, respectively.

1.3 Significance and contributions

This thesis investigates the corporate governance mechanisms among listed CEs that are under an environment with a close connection to the Chinese central government. Additional empirical evidence on this special type of SOE is provided. Whilst, Chinese listed firms share many similarities, there is sufficient heterogeneity to warrant the analysis of Chinese listed firms with different types of the ultimate owner. The following are the main contributions to the literature delivered through this work.

It first contributes to the literature on the determinants of affiliated directors. Study 1 builds a model of the expected relation between affiliated directors and ownership structure with board characteristics. Given the potential conflicting incentives between the ultimate owner and minority shareholders, it is crucial to understand how the former (i.e. the central government) influences the composition of the board of directors through the ownership structure.

Second, it contributes to the emerging market literature that documents a significant relationship between affiliated directors and firm values (Yeh and Woidtke, 2005; Yeh, 2005; Chen et al., 2014a). Study 1 subsequently involves investigating the economic consequences of affiliated directors from the central enterprises, primarily whether they affect the firm

value of listed CEs. It sheds light on how the central government impacts on the listed CEs through the board of directors.

Third, this work contributes to the literature on independent directors and investment efficiency. Following the existing literature (Richardson, 2006; Shen et al., 2015; Chen et al., 2016), Study 2 constructs an investment model and uses the absolute value of its residuals as the proxy for investment efficiency. In addition to the linear relation, Study 2 also examines the potential non-linear relationship between independent directors and investment efficiency. Given widespread investment problems among listed CEs, it is important to probe whether the independent director system is an effective corporate governance mechanism that can improve the investment efficiency of listed CEs.

Fourth, the thesis outcomes add new evidence to the existing literature that documents a significant relationship between the supervisory board and financial reporting quality (Ran et al., 2015). Study 3 investigates the function of the supervisory board according to various dimensions, including supervisory board size, board composition, board characteristics, and board incentives. It provides detailed evidence on the aspects of the supervisory board that may have significant effects on financial reporting quality, which thus includes the reform direction that could lead to more effective supervisory boards of listed CEs.

Last, this thesis has political implications for SOE reforms. The three empirical studies are all related to corporate governance mechanisms among listed CEs, each empirically examining the achievements of the SOE reform and shedding light on where further reform should be directed. In addition, it provides robust evidence that allows for making recommendations as to how the policymakers should amend the relevant regulations to strengthen the corporate governance system in listed CEs or even in all Chinese listed firms.

1.4 The organisation of this thesis

The thesis consists of six chapters. Chapter 1 provides an overview of this work, whilst Chapter 2 introduces the research background relating to Chinese SOEs. There are three specific research questions following the theme that involves investigating the effectiveness of corporate governance mechanisms in listed CEs. In Chapter 3 (Study 1) identifies the determinants of affiliated directors from the central enterprise or its affiliations, with an examination of the effect of these directors on firm value. Chapter 4 (Study 2) addresses the research question as to whether the independent director system is an effective corporate governance mechanism for improving investment efficiency in listed CEs. Chapter 5 (Study 3) investigates the relationship between the supervisory board and financial reporting quality, whilst Chapter 6 summarises the thesis.

Chapter 1 has introduced the research theme, scope, and objectives. This chapter also has discussed the contributions of this thesis to the corporate governance literature and the structure of the work.

Chapter 2 provides an overview of Chinese SOEs. This chapter first reviews the process of SOE reforms from 1978 to the current and, then, gives the classification of SOEs with their recent years' performance. Next, this chapter explains what central enterprises are, and provides the definition of listed CEs employed in this thesis. Lastly, this chapter discusses the special governance environment of listed CEs.

Chapter 3 (Study 1) provides a complete study on the determinants of affiliated directors from the central enterprises and their effect on firm value. It starts with an introduction to this research topic, followed by a review of the literature about ultimate owner incentives, affiliated directors and firm value, which leads to the development of related hypotheses. The empirical model and data are introduced, followed by the empirical results with robustness checks being provided and some related additional tests are reported on. Finally, the chapter concludes with a summary of the main findings regarding the determinants of

affiliated directors and their effect on firm value, with consideration of the consequent implications from the analysis outcomes.

Chapter 4 (Study 2) provides an independent study relating to the relationship between independent directors and investment efficiency in listed CEs. It first provides an overview of the research question, followed by a review of the literature on independent directors and investment efficiency as well as the existing empirical evidence on the relation between these two factors. The related hypotheses are developed subsequently. Next, Study 2 establishes the employed regression models, describes data, and reports the empirical results with sensitive checks. Furthermore, this study conducts extended tests relating to the performance and characteristics of independent directors as well as the effect of the ultimate owner on the relation between these two factors. Lastly, this study concludes with a discussion regarding main findings for the relationship between independent directors and investment efficiency and thus, subsequently providing political suggestions from this analysis.

Chapter 5 (Study 3) presents an integrated study on the relationship between the supervisory board and financial reporting quality. It starts with an overview of this research topic, followed by a review of the literature on the supervisory board and financial reporting quality, as well as the existing empirical evidence about them. The research hypotheses are developed from four aspects of the supervisory board. Next, the research design and data are presented, followed by the empirical results with robustness checks. This study also conducts related additional tests. Lastly, there is a summary of the main findings regarding the relationship between the supervisory board and financial reporting quality, with the political implications from this analysis being subsequently discussed.

Chapter 6 concludes this thesis. This chapter contains a summary of the main results, presents recommendations and implications, discusses the limitations, and provides suggestions for further research in this area.

Chapter 2 Chinese Central Enterprises

2.1 Introduction

The reform of SOEs has been regarded as an important link in China's economic reform. Most SOEs in China have experienced corporatisation[2] and shareholding reforms aimed at creating a modern enterprise system with an improved governance structure. This has the purpose of transforming SOEs from traditional state-run enterprises under a planned economy into "new SOEs" under a market economy (Huang, 2018). The listed central enterprises (listed CEs) ultimately owned by the central government are the leading enterprises in this ongoing reform, as they are more politically sensitive than other firms, with most of them being in important or monopoly sectors, such as defence, utilities, oil and gas. In order to understand Chinese central enterprises and their listed CEs, it is necessary to start by introducing the SOE reform.

The rest of the chapter proceeds as follows. Section 2.2 reviews the process of the SOE reform. Section 2.3 introduces the classification of SOEs in China and their financial performance. Section 2.4 and 2.5 provide the definition of the central enterprises and listed central enterprises (listed CEs), respectively. Section 2.6 discusses the special governance environment among listed CEs.

[2] Corporatisation is the process of transforming state assets, government agencies and/or municipal organisations into corporations. It involves restructuring the government and public organisations into joint-stock, publicly listed firms in order to implement modern corporate management techniques in their operation.

2.2 The Chinese SOE reform

In the development process of the economy in China, one of the prominent features is the state-owned enterprises (SOEs) that dominate the whole economy. In order to improve the separation of government from management in SOEs and to convert the centrally-planned economy[3] into a socialist market economy[4], the government carried out the SOE reform in the 1980s. Since then, SOEs have experienced significant structural changes.

There are four stages of the process of the SOE reform: expanding the autonomy of management among SOEs during 1978 to 1992; creating a modern enterprise system from 1993 to 2002; establishing a new system for the administration of state assets during 2003 to 2012; and further reform based on a new classification introduced in 2013 (Hu, 2018; Huang, 2018). Table 2-1 summarises the actions during these four phases of SOE reform.

Table 2-1 Summary of the process of SOE reforms

Stage	Main tasks	Key documents
1978-1992 The Period of Decentralisation and Interest Concessions	The primary task of the reform in this stage was to give the autonomy of management to SOEs, in order to separate government from business. Before that, SOEs were under the highly centralised planned economic system and completely relied on government planning and administrative allocations, such as human, financial and material resources, as well as production and sales activities. It was to help SOEs escape from the fetters of obsolete concepts and behaviours under the planned economic system, adapt to a commodity-based business environment, and complete the corporatisation reform. The period of expanding autonomy in SOEs can be further divided into the following three phases: 1978-1984 the increase of autonomy;	The State Council announced *Several Provisions on Expanding the Autonomy of State-owned Enterprises* in July 1979.

[3] A centrally-planned economy is an economic system where investment and the allocation of capital goods are planned by the central government in advance (Kanbur and Zhang, 2005).

[4] A socialist market economy is the economic model employed by China, which is based on the dominance of the state-owned sector and an open-market economy. It is a mixed product of free competition and government intervention (Ding, 2009).

	1985-1989 implementations of the contract responsibility system; 1990-1992 the reform of the corporate operation mechanism.	
1993-2002 The Period of Institutional Innovation	The first task of the reform in this stage was to restructure major enterprises and to relax the control over small ones. Big enterprises were encouraged to transform into groups or to establish partnerships with each other. Small public enterprises were reformed flexibly following the demands of the market, such as becoming shareholding businesses, transacting mergers and making acquisitions or contracting managing rights to individuals. The second task of the reform in this stage was to establish a modern enterprise system characterised by clear property rights, well-defined authority and responsibilities, the separation between government and business, and scientific management.	*The Decision of the Central Committee of the Communist Party of China on Major Issues Concerning the Reform and Development of State-owned Enterprises* was adopted at the Fourth Plenum of the 15th Communist Party of China (CPC) Central Committee on September 22, 1999.
2003-2012 The Period of SASAC Administration	The State Assets Supervision and Administration Commission (SASAC) was established by the State Council in 2003. This single authority (i.e. SASAC) ended the situation that multiple inefficient bureaucracies administrated the state-owned assets. The preliminary supervision and administration system of state-owned assets was established.	The State Council issued *Interim Measures for the Supervision and Administration of State-owned Assets of the Enterprises* in May 2003. These were revised in 2011 and 2019. The Standing Committee of the 11th National People' Congress approved *Law of the People's Republic of China on the State-owned Assets of Enterprise*. It has been effective since May 1, 2009.
2013-ongoing The Period of the Classified Reform	This period is described as a comprehensively deepening phase of the SOE reform. In 2015, the government classified SOEs into three categories: public-interest SOEs, commercial SOEs with the primary business in fully competitive sectors and commercial SOEs with the primary business in important and critical sectors. According to the characteristics of different types of SOEs, they will be subject to different mechanisms and assessments for the supervision of state assets, mixed ownership reform schemes, corporate governance mechanisms and the strategic adjustment of the state sector of the economy.	*The Decisions on Major Issues Concerning Comprehensively Deepening Reforms* was adopted at the 18th CPC Central Committee on November 12, 2013. The State Council issued *Guiding Opinions of the CPC Central Committee and the State Council on Deepening the Reform of State-owned Enterprises* in August 2015. This and supporting documents formed a "1+ N" policy system. Appendix 1 shows the details about the supporting documents.

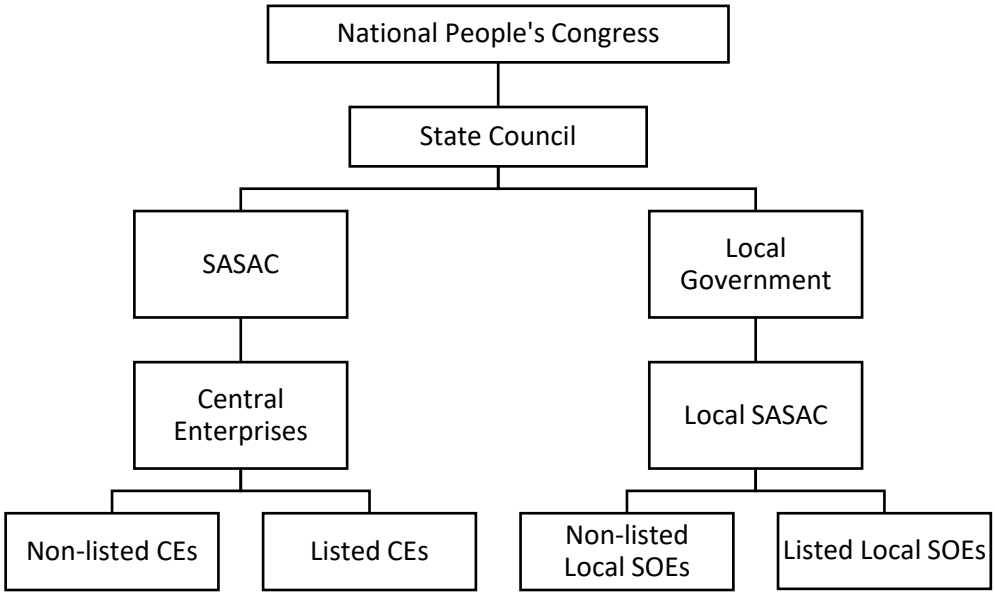
Source: translated excerpt from Hu (2018); Huang (2018)

Huang (2018) argues that the SOE reform has made significant achievements, such as 64 SOEs being ranked as Global 500 companies in 2017. However, he also points out that these large enterprises still have not met the criteria to be the world-class enterprises and hence, they need further reform in order to meet the requirements of the socialist market economy. In addition, Hu (2018) argues that the significant loss of state-owned assets during the SOE reforms should be noted as well. During the SOE restructuring, foreign and domestic private capital were involved through the transfer of the ownership of state shares or state assets. However, a lot of state-owned assets were deliberately underestimated during this process. Furthermore, given the weak legal supervision, some executives of SOEs sold state assets to their relatives at very low prices in order to achieve great private benefits. This kind of behaviour can be regarded as an alternative format of corruption. In sum, the literature suggests that the central government should continue the comprehensive reform for SOEs.

2.3 The classification of SOEs and their performance

SOEs can be classified according to the institutions that the state assets are managed by. Figure 2-1 displays the administration relationship among the government institutions that have the responsibility of managing state assets. The top level is the National People's Congress (NPC) and below that is the State Council. Under this organisational structure, the administrators of state assets are divided into two branches. Central enterprises are administrated and monitored by the State-owned Assets Supervision and Administration Commission (SASAC), whilst the relevant local governments manage the local state assets. In this study, the focus is on the central enterprises and their listed subsidiaries (listed CEs) that are controlled and supervised by SASAC, which is the left branch in Figure 2-1.

Figure 2-1 State-owned asset management system in China



Source: this research

SASAC discloses the information regarding SOEs' performance annually and Table 2-3 shows the detailed financial information for recent years. The total realised profit of all SOEs in 2012 was 2,195.96 billion RMB, which increased to 2,476.54 billion RMB in 2014, whilst in 2015 it fell to 2,302.75 billion RMB and the figure for 2016 was 2,315.78 billion RMB. Figure

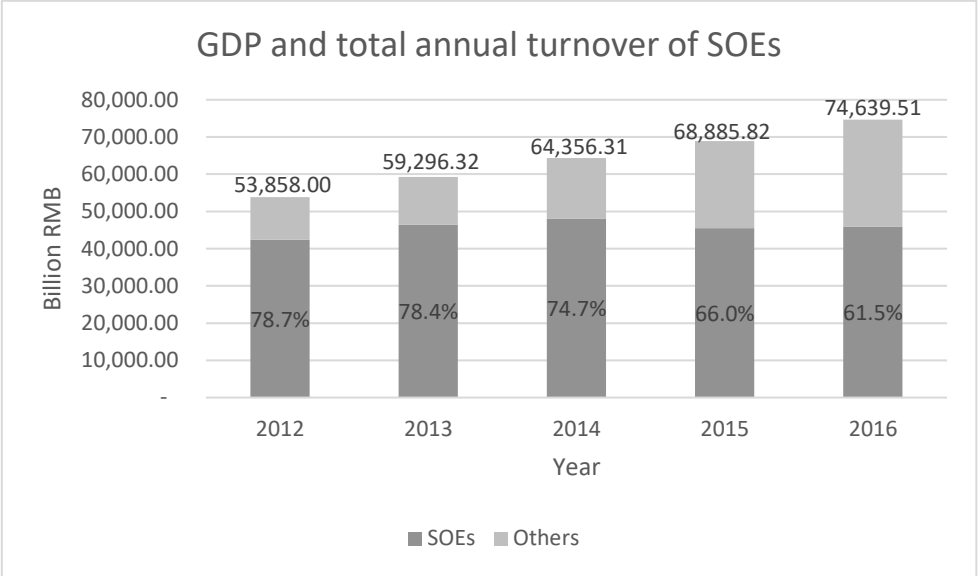
2-2 shows the importance of SOEs in the economy of China, as in the period 2012 to 2016, the average ratio of total annual turnover of SOEs to GDP was 71.86%. Figure 2-3 displays the contributions of the central enterprises and local SOEs to the total annual turnover of all SOEs and Figure2-4 shows the contributions of these two kinds of SOEs to total realised profit. It is clear that the central enterprises are important in the state assets economy, as on average around 60% of total revenue and about 68% of the total profit are from them. However, their performance has not been as good as that of local SOEs. The average growth rate of profit from 2012 to 2016 was 3.73% in local SOEs and 0.597% in central enterprises. A study conducted by Guo (2011) reported that the performance of listed CEs was the worst when compared to both other listed SOEs and listed non-SOEs in a period of 2007 to 2009. Hence, the inefficient development of the central enterprises should be noted.

Table 2-2 The financial performance of SOEs for 2012 to 2016 (unit: billion RMB)

Year	Type	Total annual turnover	Total cost	Total realized profit	Total tax payable
2012					
	CEs	26,055.85		1,504.54	2,525.07
	local SOEs	16,321.11		691.42	824.56
	total SOEs	42,376.96	40,657.03	2,195.96	3,349.63
2013					
	CEs	28,440.71	27,215.13	1,665.28	2,803.02
	local SOEs	18,034.21	17,681.85	739.77	878.18
	total SOEs	46,474.92	44,896.98	2,405.05	3,681.20
2014					
	CEs	29,379.03	28,172.77	1,728.02	2,916.99
	local SOEs	18,684.61	18,487.77	748.52	869.09
	total SOEs	48,063.64	46,660.54	2,476.54	3,786.06
2015					
	CEs	27,169.40	26,240.76	1,614.89	2,973.14
	local SOEs	18,301.01	18,278.85	687.86	886.73
	total SOEs	45,470.41	44,519.61	2,302.75	3,859.87
2016					
	CEs	27,678.36	26,803.99	1,525.91	2,915.30
	local SOEs	18,219.44	18,184.51	789.87	892.31
	total SOEs	45,897.80	44,988.50	2,315.78	3,807.61

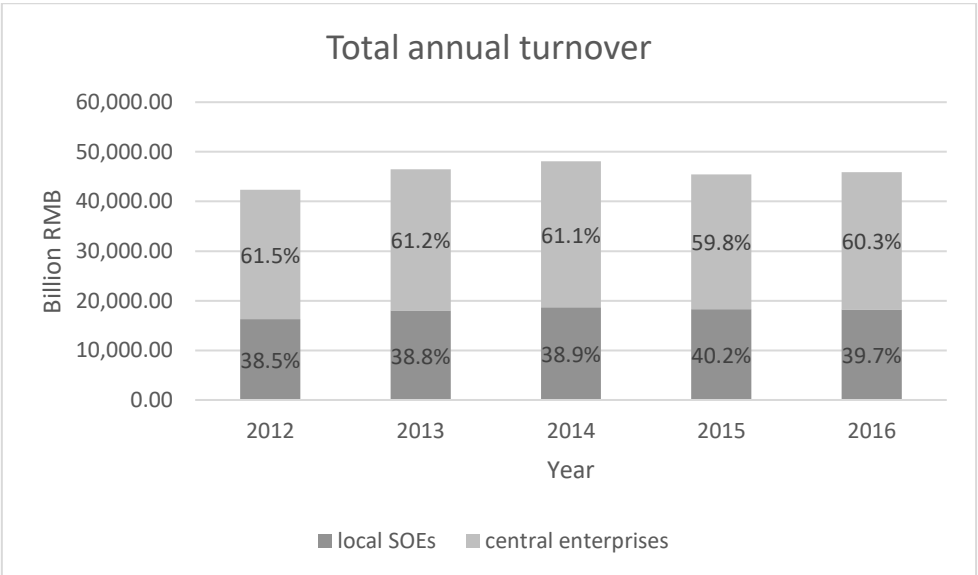
Note: This table reports the financial performance of central enterprises, local SOEs and total SOEs. SASAC did not disclose the total cost of central enterprises and local SOEs in 2012.
Source: SASAC

Figure 2-2 GDP and total annual turnover of total SOEs



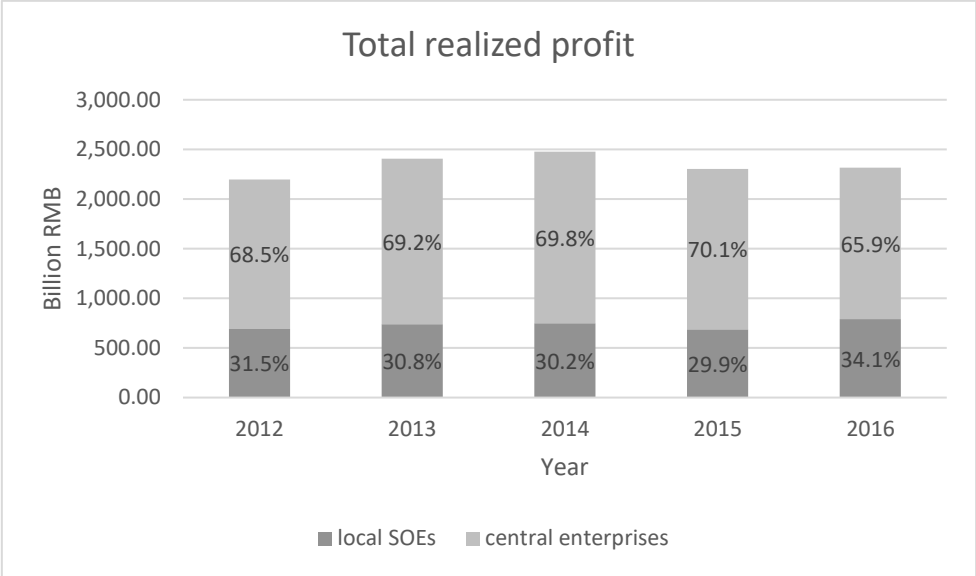
Source: SASAC, National Bureau of Statistics of China

Figure 2-3 The total annual turnover of central enterprises, local SOEs and total SOEs



Source: SASAC

Figure 2-4 The total realised profit of central enterprises, local SOEs and total SOEs



Source: SASAC

2.4 Chinese central enterprises

The Interim Measures for the Administration of State-owned Equity of Corporations (1994) define state shares as being those held by the central government, local governments, or solely government-owned enterprises. Hence, a central enterprise, here defined as a solely government-owned enterprise, equates to a government institution. The narrow definition of a central enterprise in China is that the conglomerate has been solely raised and is owned by the central government, being administrated directly by the State Assets Supervision and Administration Commission (SASAC). When SASAC was established in 2003, China had 196 central enterprises. Then, the central government conducted their annexation and recombination. By doing so, the central enterprises could achieve resource integration that optimised allocation and it reduced disorderly competition of being competitors with their subsidiaries in the same sector. By the end of 2018, the number of central enterprises had decreased to 96. Among the 100 disappeared ones, 53 were wholly absorbed by relevant

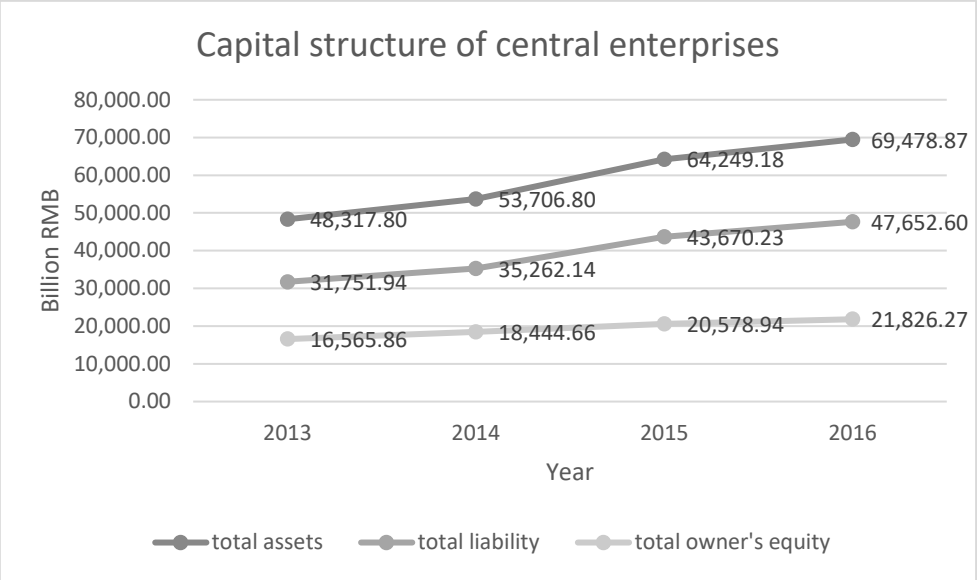
industrial groups, 19 enterprises were horizontally reconstructed, and 18 experienced upstream and/or downstream[5] integration.

The number of central enterprises ranked as amongst the Global 500 companies was six in 2003, when SASAC had just been established and then it increased to 48 in 2017. Figure 2-5 shows the capital structure of central enterprises in the period 2013 to 2016. The increase of total assets of central enterprises from 48,317.80 billion RMB to 69,478.87 billion RMB indicates that they have experienced fast expansion. “Be stronger and larger” is the major goal of the central enterprise reform; however, whilst the rapid expansion of central enterprises had made them larger, this had not led to their being stronger. This is because a significant increase in total liabilities has accompanied the expansion of their size.

In Figure 2-5, the total liabilities increased from 31,751.94 billion RMB in 2013 to 47,652.60 billion RMB in 2016 and average debt to total assets ratio was 67% in the period from 2013 to 2016. This relatively high average leverage ratio of SOEs got the attention of the government. Subsequently, SASAC regulated the red lines of the leverage ratio for central enterprises in 2018, in order to mitigate their inefficient development due to the blind expansion and heavy pressure of debts. Specifically, the government has set the warning line at 70% in the manufacturing industry, 75% in the non-manufacturing industry, and 65% in the technology industry. Moreover, Leutert (2016) points out that the lack of an information-sharing system, weak oversight, frequently overlooked politics, and enduring cadre culture are intra-firm obstacles to central enterprise reform as well[6].

[5] The recombination of central enterprises has been different to other SOEs regarding commercial merger and acquisitions, as one central enterprise is wholly transferred to another without consideration.
[6] See Leutert (2016) for detailed discussion about the firm-level obstacles to the central enterprise reform.

Figure 2-5 The capital structure of central enterprises



Source: SASAC

As aforementioned, the central enterprises are concentrated in sectors considered important by the state. In particular, they are in those closely related to state security and the national economy, such as defence, utilities, oil and gas, telecommunications, coal, civil aviation and shipping, among others. The central government keeps absolute control power in order to avoid potential threats to state assets. Also, the central enterprises are never allowed to go public directly, for doing so would lead to the dilution of the controlling power from the central government.

2.5 Chinese listed central enterprises

In the Chinese market, SOEs are playing a leading role in advancing modernisation and safeguarding public interests. China's central authorities issued guidelines (2015)[7] to promote SOE reform, the purposes of which being to improve SOEs' international competitiveness, innovation and international influence. The partial privatisation[8] (mixed-

[7] *Guiding Opinions of the CPC Central Committee and the State Council on Deepening the Reform of State-owned Enterprises* issued by the State Council in August 2015.

[8] Partially privatisation means that part of a firm's assets is privatised, and the control rights have been transferred from the government to private owners, but the former remains as the controlling owner.

ownership) has been the most significant reform, which has increased corporate governance and financial performance of SOEs (Sam, 2011). The guidelines state that SOEs should bring in multiple types of investors and the government should encourage them to go public. By doing so, this promotes the separation of government from management, thereby turning them fully into business entities. In contrast, the central enterprises are fully controlled by SASAC. One way that they may participate in the market economy is to list their subsidiaries publicly or to invest through the acquisition of already listed firms. These publicly listed firms that are ultimately controlled by the central enterprises are defined as listed central enterprises (listed CEs).

There are several ways for determining that a central enterprise ultimately controls a publicly listed firm, including: (1) the voting rights of the shares solely controlled by the central enterprise, or jointly with its affiliates, exceed those of non-government shareholder with the biggest stake of shares; (2) the central enterprise controls a firm's share with its voting rights reaching or exceeding 30%; (3) the central enterprise has the power to appoint half of the directors on the corporate board through single or jointly controlled voting rights; or (4) the central enterprise can control a firm's financial and business strategies, thereby gaining profits from this firm's operating activities. If a central enterprise matches any of these conditions[9], then it is called the ultimate controller (largest shareholder) of this listed firm.

2.6 The governance environment among listed CEs

In the typical Chinese corporate governance structure (Figure 2-6), the general shareholder meeting is the highest institution in a listed firm. At this meeting, shareholders elect the board of directors and the board of supervisors. The board of directors is in charge of the decision-making of the firm, monitoring its performance and assessing that of the

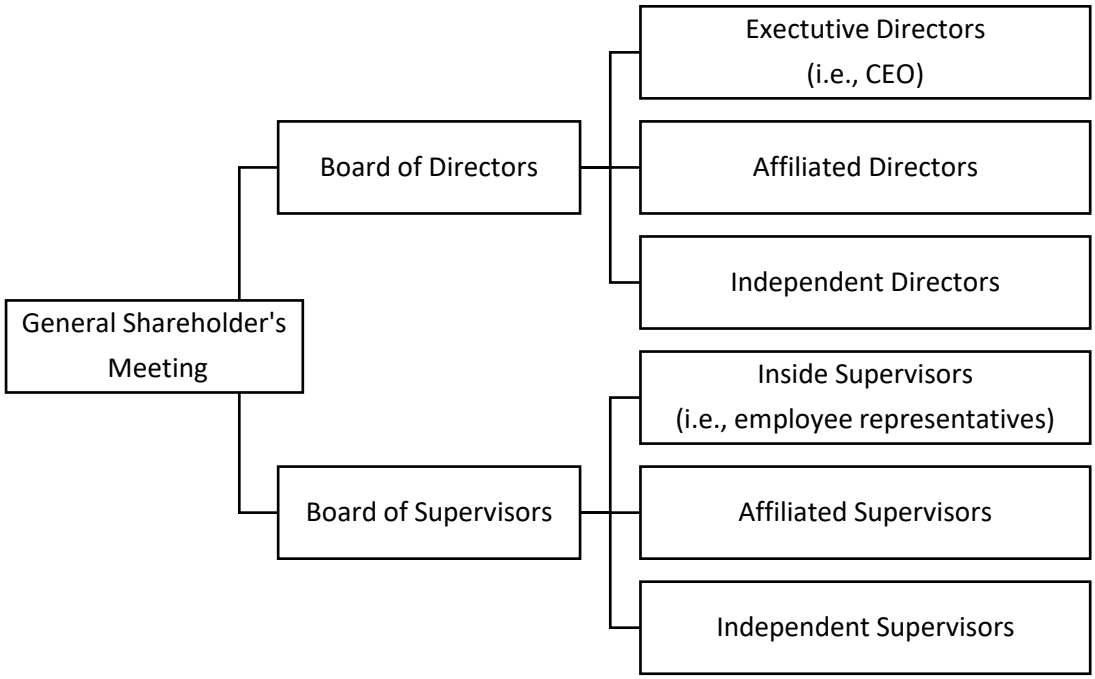
[9] The *Administrative Rules on Acquisition of Listed Companies*, the *Rules for the Listing Stocks* set by the Shenzhen and Shanghai Stock Exchange, the *Guidelines of the Shenzhen Stock Exchange for the Conduct of Controlling Shareholders*, and the *Guidelines for the Standardised Operation of Companies Listed on the Small and Medium-Sized Enterprise Board*.

management. It comprises executive directors (e.g. the managerial executives), affiliated directors (e.g. the representatives from the large shareholders), and independent directors.

In 2001, CSRC issued the *Establishment of Independent Director Systems by Listed Companies Guiding Opinion*, which marks the official introduction of the independent director system in China. This guiding opinion points out the qualifications of independent directors to make sure that the independent directors can exercise their functions and powers. Additionally, in order to demonstrate the "independence" of independent director, the guiding opinion lists seven conditions (Appendix 2) that the person who follows those conditions may not hold the position of the independent director. The guiding opinion also clarifies the duties and responsibilities of independent directors and regulates the process of nomination, election, and replacement of independent directors. What is more critical, CSRC rules the proportion of independent directors on the corporate board. By 30 June 2003, at least one-third of the members of the board of directors should be independent directors.

The board of supervisors takes the responsibility of supervising the behaviour of both the directors and executives, comprising inside supervisors (e.g. the employees of the firm), affiliated supervisors (e.g. the representatives from the large shareholders) and independent supervisors. Whilst independent directors and the supervisory board share a similar function of monitoring, the former can participate in the decision-making process and the latter focuses on monitoring the quality of a firm's financial information. The revised *Company Law* (2015) regulates that the supervisory board has the right to give advice on appointing or dismissing executives, rather than making this decision directly. This shows that, in China, the board of directors and the board of supervisors are parallel institutions in the firm.

Figure 2-6 The corporate governance structure in China



Source: this research

Although the Chinese government has implemented a series of reforms to accelerate the separation of government from management, the listed CEs are still significantly influenced by their parent firms (i.e. the central enterprises).

Similar to other listed SOEs, the listed CEs have a relatively complicated principal-agent relationship (Qiang, 2003). The multilayer principal-agent mechanism shows a vertical relationship chain (Figure 2-1) starting from the NPC (National People's Congress) at the top, follow by SASAC, central enterprises, and finally, listed CEs at the bottom. This long relationship chain reduces the efficiency of corporate governance in such listed firms. There is a principal-agent at each level apart from the top and bottom ones shown in Figure 2-1, which means that these principals in the middle levels lack any enthusiasm to monitor what they perceive as an inferior accompanying agent (Rodríguez et al., 2007). As has been noted, SASAC acts as the owner of state assets on behalf of the state. Meanwhile, it takes on the direct responsibilities of supervising and administrating the state assets as a governmental administrative agency. Pei et al. (2019) argue that the market role (i.e. as a controlling

shareholder) of SASAC conflicted with its regulatory role (i.e. as a supervisor and administrator). In which case, SASAC could not perform well as the owner of state assets and hence, the absence of the owner problem among listed CEs still existed even after its establishment. Furthermore, if the supervision from SASAC is insufficient, the residual rights of listed CEs may be allocated to the management of central enterprises, which could lead to a higher possibility of self-interest behaviours of the management team, such as the abuse of the authority to graft.

The *Company Law of the People's Republic of China* (2013 Amendment) specifies, "The member of the board of directors in a wholly state-owned company shall be appointed by the state-owned assets supervision and administration institution (SASAC)." and "Upon consent of the state-owned assets supervision and administration institution (SASAC), the director may concurrently hold the position as a manager". Under the condition introduced, the directors and top executives of central enterprises are appointed by SASAC, which brings a strong political connection into them. Meanwhile, article 69 of the *Company Law* specifies that "None of the chairman, deputy chairman, directors and senior managers of a wholly state-owned company may concurrently take up a position in any other limited liability company, joint stock limited company or other economic organisations unless gaining the consent of the state-owned assets supervision and administration institution (SASAC)". In other words, the top management of a central enterprise can concurrently hold a position in listed CEs under the consent of SASAC. By having this situation, the listed CEs have more significant political influence than do other listed SOEs.

As a part of central enterprises, listed CEs are under the administration of SASAC, whilst at the same time, being supervised by CSRC providing they are listed. Under the dual supervision, when, for example, the listed CEs plan to conduct material assets reorganisation or to issue bonds, the first step is getting the consent from SASAC. Then, the arrangement is discussed at a general meeting, whilst finally, the decision is reported to CSRC for approval. In sum, compared with other listed firms, the listed CEs spend much more time in finalising the decision.

As creating a modern enterprise system is one of the main tasks of the SOE reform, more and more corporate governance mechanisms are introduced into Chinese SOEs. Given the above discussion, the corporate governance environment of listed CEs is more complicated. Hence, this thesis aims to examine whether the corporate governance mechanisms do play an effective role among listed CEs under such a complicated governance environment. Specifically, three independent studies are conducted to explore: the determinants of affiliated directors from the central enterprise or its affiliations and their economic consequences; the effect of independent directors on investment efficiency; and the impact of the supervisory board on financial reporting quality among listed CEs, respectively.

Chapter 3 (Study1) Ultimate Owner, Affiliated Directors, and Firm Value

3.1 Introduction

The effect of the controlling shareholder's ownership on firm value has been widely discussed in countries with concentrated ownership (e.g. Claessens et al., 2002; La Porta et al., 2002; Yeh, 2005; Liu and Tian, 2012; Su et al., 2016; Hooy et al., 2019). For instance, Claessens et al. (2002) document that listed firms with higher cash-flow rights from the controlling shareholder have higher firm value and that a significant wedge between control and cash-flow rights reduces this value. They identify this positive effect from the higher cash-flow rights as the incentive alignment effect that enhances firm value. Also, they term the negative effect from the divergence of control and cash-flow rights the entrenchment effect, which deteriorates firm value.

Besides the ownership structure, in fact, the corporate board is also an important channel for the ultimate owner (i.e. controlling shareholders) exercising control in listed firms. This is because that the board of directors has a crucial position in the corporate governance structure, in that it takes the role of important decision-making, strategy setting and monitoring the behaviours of the executives (Fama and Jensen, 1983; Baysinger and Butler, 1985). Furthermore, appointing a sufficient proportion of affiliated representatives is the common way for the ultimate owner to enhance control power on the corporate board of listed firms. That is, the directors who are affiliated with the ultimate owner or its affiliations may influence the decision making of the operating activities on the corporate board of listed firms.

Other studies have focused on the functions of independent directors on the corporate board. The determinants of independent directors and their economic consequences have been extensively examined around the world (e.g. Mak and Li, 2001; Prevost et al., 2002; Erickson et al., 2005; Linck et al., 2008; Zhu et al., 2016). In contrast, affiliated directors, especially those related to the ultimate owner, have not received much attention. Hence, this study investigates how the ultimate owner affects the composition of the corporate

board by placing affiliated representatives on it and the economic effect of these affiliated directors on firm value.

Chinese corporations are characterised as having a concentrated ownership structure. Wang and Xiao (2009) report that central or local governments or their agencies ultimately control 70% of Chinese listed firms. The listed central enterprises (listed CEs) are firms ultimately controlled by the central government, hence having strong political ties with it and being more sensitive to its influences. Whilst the central government ultimately owns the listed CEs, the State-owned Assets Supervision and Administration Commission (SASAC) authorises the appropriate central enterprises[10] to exercise daily control and management of these listed CEs. Hence, the central enterprises may appoint more affiliated directors onto the corporate board to strengthen their control power in listed CEs. Alternatively, the central enterprises may place fewer affiliated directors on the corporate board, thus providing more board space for directors with professional or management skills of the firms or independent directors[11]. By doing so, the corporate governance of listed CEs can be improved. This is in line with one of the main tasks of the SOE reform that was aimed at creating a modern corporate system with these companies. The existing evidence (e.g., Wang et al., 2006; Bhabra and Li, 2011; Liu et al., 2015) supports the positive function of board independence, in particular, giving more board positions to independent directors can improve corporate performance. Finally, the central enterprises can benefit from an increase in the firm value of listed CEs when there is strong corporate governance. In order to determine the effect of government intervention on the corporate board of listed CEs, and to provide evidence for the direction in which to reform them further, this study examines the potential influencing factors that motivate central enterprises on behalf of the central government to place a certain number of affiliated representatives on corporate

[10] The central enterprises are state-owned enterprises that are wholly funded and administrated by SASAC. As the central enterprise is solely owned by the central government, it is generally regarded as a "state unit" (Yeo, 2013). The central government holds the absolute control power in these enterprises.

[11] Affiliated directors mean the directors have a close tie to the ultimate owner. In the case of listed CEs, the affiliated directors are someone who concurrently hold a position in the central enterprise or its affiliations. The directors with expertise mean that the directors have working experience in the related industry or professional management skills. There may be overlap between affiliated directors and directors with expertise, which means some affiliated directors may also have management expertise. However, in listed CEs, most affiliated directors from the central enterprises generally lack professional management skills, as they are current or former government bureaucrats.

boards of listed CEs. In addition, the economic effect of these affiliated directors on corporation value is examined.

There are two parts to this study. First, there is an examination of the determinants of the proportion of affiliated directors on the corporate board of listed CEs, specifically the potential influencing factors coming from the ultimate owner (i.e. the central government). Yeh and Woidtke (2005) argue that controlling shareholders are likely to increase shareholder wealth by selecting professionals to serve as directors based on their expertise rather than affiliation. In particular, when the cash-flow investment is high, the benefit that controlling shareholders derive from increasing shareholder wealth outweighs their loss from limiting expropriation. Hence, this study hypothesises that the ownership (i.e. the cash-flow rights) owned by the central government is negatively associated with the proportion of affiliated directors. It is also proposed that the wedge between control and ownership (i.e. the divergence of the voting and cash-flow rights) is positively associated with the proportion of affiliated directors, i.e. more affiliated directors on the corporate board is helpful for central enterprises in gaining control of listed CEs. Moreover, when this is the case, it is easier for the central enterprises to engage in the expropriation of minority shareholders.

Next, this study examines the relationship between affiliated directors and the firm value of listed CEs. It is hypothesised that there is a non-linear relationship between affiliated directors and the firm value of listed CEs, whereby the effect of these directors on firm value is positive or negative depending on the proportion of board that they occupy. Affiliated directors act on behalf of central enterprises, taking responsibility for protecting the interest of the central government and hence, they are likely to play a positive role in improving the firm value of listed CEs. Correspondingly, the central government can benefit from the increase of the wealth of listed CEs. However, too many affiliated directors may lead to board inefficiency, which is negatively associated with firm value, as they generally lack professional management skills. For the second hypothesis, it is proposed that the entrenchment effect may motivate central enterprises to place more affiliated directors on the corporate board, which may also lead to a negative effect on firm value. That is, too

many affiliated directors on the corporate board may have a negative effect on firm value. Accordingly, it is hypothesised that there is an optimal proportion of affiliated directors on the corporate board leading to the highest corporation value of listed CEs. Specifically, it is proposed that there is an inverse U-shaped relationship between affiliated directors and firm value. This study conducts related extended tests, including the effect of external mechanisms on the relation between affiliated directors and firm value as well as the effect of excess board seats control (i.e. the divergence of the affiliated director ratio and the cash-flow rights) on firm value.

This study employs a sample of 942 firm-year observations consisting of 225 unique listed non-financial A-share CEs from 2012 to 2016. An affiliated director is defined a person that concurrently has a position in the central enterprise or its affiliations. It is mandatory for listed CEs to disclose the positions concurrently held by their directors in other places, so this information, which is available in annual reports of listed CEs, has to be collected manually. Other corporate governance and financial information is obtained from the Chinese Securities Market and Accounting Research (CSMAR). The main findings are as follows.

In order to avoid the causality issue, this study applies the lead/lag relation between dependent and independent variables. First, there is no significant evidence that the cash-flow rights owned by the central government influence the next period appointment of affiliated directors. However, the divergence of the voting and cash-flow rights would appear to motivate central enterprises to place more affiliated directors on the corporate board in the next period. Second, it emerges that the affiliated directors have an inverse U-shaped relationship with the subsequent firm value of listed CEs. This means that more affiliated directors on the corporate board increase the subsequent firm value of listed CEs, so long as their proportion does not reach the turning point. That is, the affiliated directors start to play a negative role on subsequent firm value, when their ratio exceeds the turning point. This curvilinear relation between affiliated directors and the subsequent firm value of listed CEs is robust under the piecewise linear regression model. This study also applies the 3SLS (three-stage least squares) regression model to examine the contemporaneous relation

between affiliated directors and the firm value of listed CEs. The results show that the contemporaneous affiliated directors and firm value jointly affect each other.

Third, this study investigates the external mechanisms that may affect the relation between affiliated directors and the firm value of listed CEs through regression analysis. The results indicate that better quality of the external audit can mitigate the negative effect of too many affiliated directors on firm value, as the coefficient of the affiliated director ratio is positively significant, and the quadratic term of this ratio is insignificant in the group that are clients of the big four accounting firms. However, there is no significant effect of the presence of foreign institutional investors on the relation between affiliated directors and the firm value of listed CEs. Last, following Yeh and Woidtke (2005) and Young et al. (2007), an alternative measure of the separation of control and ownership (i.e. the affiliated director ratio and cash-flow rights) is deployed to examine whether this excess board seats control affects the valuation of listed CEs. There is a negative effect of excess board seats control on the firm value of listed CEs. This result is robust under three measures of excess board seats control (ratio, difference and dummy). In addition, it is elicited that the external mechanisms (the external audit and foreign institutional investors) can mitigate the negative influence of excess board seats control on firm value in listed CEs.

This study contributes to the literature on board composition. First, it offers new insights on the determinants of board composition from an ultimate owner perspective, finding that the separation of control and ownership motivates the ultimate owner to place more affiliated directors on board. Overall, the ultimate owner has a significant influence on the corporate governance of listed firms. Second, the outcomes confirm the effect of affiliated directors on firm value, which enriches the literature on the functions of different kinds of directors on the corporate board. In particular, there is a non-linear relation between affiliated directors and firm value. Third, this study focuses on listed CEs, the ultimate owner of which is central government. The discussions about how the central enterprises acting on behalf of the central government affect the corporate board structure of listed CEs have implications for further central enterprise reform in China. Whilst the reform continues separating the Chinese central government from business, in reality, the former still

participates in the management of listed CEs by placing affiliated directors on their corporate boards. It cannot be denied that, the central government must hold certain control of listed CEs, as they are important state assets, but what is the appropriate level of governmental control? The government and academics are still seeking the answer to this question. The suggestion to central government arising from the findings of this study is to control the proportion of affiliated directors on the corporate board at a certain level, especially in situations where the central enterprises place too many such directors on the corporate board of listed CEs, with a small equity stake.

The rest of the study proceeds as follows. Section 3.2 introduces the related literature and develops the hypothesis. Section 3.3 provides the details of research methodology and data. Section 3.4 reports the main empirical findings and sensitivity tests. Section 3.5 presents the empirical results of extended tests. Section 3.6 discusses this study.

3.2 Literature review and hypotheses development

It is widely documented that ownership in developing countries is highly concentrated (La Porta et al., 1999; Claessens et al., 2000). Under a concentrated ownership structure, conflict of interest between the agent and the principal in publicly traded firms is not between managers and shareholders, but between ultimate controlling shareholders and minority shareholders. The expropriation of minority shareholders is more common in the developing countries, as La Porta et al. (1999) and Claessens et al. (2000) find that the ultimate shareholders typically have more control rights than their cash-flow rights. The deviation of cash-flow from control rights motivates the ultimate controlling shareholder to divert private benefits and consequently, reduces the firm value of a listed firm. This is because the willingness to expropriate value is less restrained by the equity ownership owned by the controlling shareholders (Young et al., 2007).

Moreover, another motivation for controlling shareholders to extract the value of listed firms is that the protection of minority shareholders is relatively weak in developing countries (La Porta et al., 2002). Claessens et al. (2002) employ the cash-flow rights and the divergence of control (voting) and cash-flow rights to examine the incentive alignment and entrenchment effects of controlling shareholders, using a sample of 1,301 listed firms from eight East Asian economies in 1996. Their empirical results show that the cash-flow rights of controlling shareholders have a positive incentive effect on firm value. In contrast, the wedge between control and ownership from controlling shareholders has a negative effect on firm value. La Porta et al. (2002) put forward a similar argument that listed firms with higher cash-flow rights being owned by the ultimate controlling shareholder have higher corporation value, using evidence from 539 large firms from 27 wealthy economies. The incentive alignment and entrenchment effects of the ultimate owner also affect the indicators of a firm's corporate governance level, such as accounting information quality (Fan and Wong, 2002; Haw et al., 2004; Young et al., 2007; Bozec, 2008), dividend policy (Faccio et al., 2001; Mancinelli and Ozkan, 2006; Ramli, 2010), external financing cost (Guedhami and Mishra, 2009; Chong, 2010; Chu et al., 2014), and so on.

The work of La Porta et al. (1999,2002), Claessens et al. (2000,2002) and Faccio and Lang (2002) show the patterns of corporate ownership around the world, and the presence of a concentrated ownership structure in developing economies. However, none of the work pertains to the economy of mainland China, which is one of the largest developing countries in the world. Similar to the evidence found in other Asian economies, the capital market in China has a concentrated ownership structure. Also, it is dominated by state shares (Xu and Wang, 1999; Wang and Xiao, 2009). The effect of these shares on firm performance in China has been widely discussed and the results are mixed. For instance, Xu and Wang (1999) report that the proportion of state shares has no relation with firm profitability, but it has a negative effect on labour productivity. In contrast, Tian and Estrin (2008) find that the state shareholding has a U-shaped relation with firm value, using a large sample of Chinese listed firms in the period from 1994 to 2004. They argue that the government can actually improve the value of listed firms when its shareholding is relatively large. Yu (2013) confirms the U-shaped relation between state ownership and firm performance with a sample of Chinese listed firms during 2003 to 2010. The author also holds that a concentrated state ownership structure is better than a dispersed ownership one due to the benefits of government support and political connections.

However, few studies have investigated the effect of the government as the ultimate owner of listed firms. Yu and Zheng (2014) examine the relationship between the ultimate owner and board independence, using Chinese listed firms for a period from 1997 to 2008. They employ a dummy variable to distinguish whether the local or central government ultimately owns a listed firm. Their empirical results show that the listed firms ultimately controlled by the government are negatively related to the independence of the corporate board. The listed SOEs prefer politically connected directors without professional backgrounds[12], while, the listed non-SOEs are more likely to choose independent directors or politically connected directors with professional business backgrounds. Despite the study by Yu and Zheng (2014) concluding that the government has a different incentive to select board members, it does not further distinguish between the local and central government as the ultimate owner or

[12] Yu and Zheng (2014) define politically connected directors without professional backgrounds as those directors who are current or former government bureaucrats without professional business or academic backgrounds (i.e. professors, CPAs, lawyers, or other professional with experience working in a financial institution or accounting.)

identify the specific factors that may influence the government in appointing directors onto the corporate board. Therefore, this study is focused on the central government, investigating how it affects listed firms as the ultimate owner. To this end, in this study, the ownership structure of the central government is examined to determine its effects on the appointment of directors on the corporate board of listed CEs. Furthermore, this study investigates the economic consequences of affiliated directors to firm value for listed CEs.

3.2.1 The effect of the ultimate owner on the appointment of directors

The board of directors is the key internal corporate governance mechanism in listed firms for mitigating the agency problem due to the separation of management and ownership (Fama and Jensen, 1983; Williamson, 1983). Under firms with concentrated ownership, as Fama and Jensen (1983) argue, the board of directors has a crucial role in restraining the intervention from the controlling shareholders on the important decision-making of listed firms, which may dampen the potential expropriation of minority shareholder's wealth. However, Yeh and Woidtke (2005) contend that in such instances, board composition is likely to be affected by the controlling shareholders as well. The general shareholder meeting elects the board of directors and thus, the shareholders with substantial voting rights have a significant influence on board composition. For instance, they can appoint more representatives on the corporate board, if they so wish. Correspondingly, they can exercise control over listed firms through the corporate board. Yeh and Woidtke (2005) examine Taiwanese listed firms and find that the proportion of directors affiliated with the ultimate controlling shareholder can be an indicator as to whether that entity intends to enhance the quality of corporate governance or transfer the resources away from the listed firms. They elicit that the separation of voting and cash-flow rights increases the proportion of affiliated directors on the board. This implies that the ultimate controlling shareholder increases his/her power on the corporate board and makes it easier to divert corporate resources away from listed firms. On the other hand, they find that higher cash-flow rights from controlling shareholders reduce the proportion of affiliated directors on the board in listed family-controlled firms, as the ultimate owner has the incentive to add more professionals to the corporate board in order to manage listed firms efficiently. Overall, the

incentive alignment or entrenchment effect that the ultimate owner would like to exercise determines the corporate board structure of listed firms with a concentrated ownership structure.

For listed CEs, the central enterprises take the role of the ultimate owner. On behalf of the central government, they have a significant influence on the election of directors on the corporate board even with a relatively small ownership stake. The purpose of the incentive alignment or entrenchment effect from the ultimate owner with such high political connections becomes more complicated. When central enterprises hold relatively high cash-flow rights of listed CEs, they are more likely to improve the performance of listed CEs. Hence, the central enterprises may prefer the corporate board to have more professionals with experienced management skills instead of their own representatives. However, the political and social goals may motivate them to transfer the resources from the listed CEs to other affiliations in the business group, especially when the cost of diversion is relatively low. In this case, the central enterprises may put more affiliates on the corporate board of listed CEs to realise tunnelling activities. Based on the previous literature, this study proposes two hypotheses regarding the effect of the ultimate owner on the board composition of listed CEs.

H1: Ceteris paribus, the ownership (cash-flow rights) held by the central government is negatively related to the proportion of affiliated directors in listed CEs.

H2: Ceteris paribus, the separation of control and ownership (the deviation of voting and cash-flow rights) held by the central government is positively related to the proportion of affiliated directors in listed CEs.

3.2.2 The economic consequences of affiliated directors

Few studies have examined the performance of directors affiliated with the ultimate owner and the outcomes of the existing empirical evidence are mixed. Yeh and Woidtke (2005) investigated the causes and consequences of directors affiliated with ultimate controlling

shareholders, using a sample of 251 Taiwanese firms in 1998. They find that higher board affiliation leads to lower firm value, especially in family-controlled firms. Yeh (2005) also elicits that the listed firm has a relatively lower corporation valuation, when more than half of corporate board members are from the controlling shareholder. Jameson et al. (2014) confirm the negative effect of controlling shareholder board membership with a sample of 1,796 Indian firms and discover that the controlling shareholder holding the key position on the corporate board (e.g. CEO) has a negative effect on firm performance (measured by Tobin's Q). These studies agree that the effect of the affiliation with the ultimate controlling shareholders on firm value is negative. The developed hypothesis for this study holds that the benefit of expropriating the resources of listed firms outweighs that of improving the wealth of listed firms, when the ultimate owner has a significant wedge between control and ownership. In this situation, the ultimate owner prefers that the corporate board contains more directors who would make decisions in his/her favour instead of the most suitable person. Accordingly, more affiliated directors from the ultimate owner may lead to a negative effect on firm value. For instance, Huyghebaert and Wang (2012) use the sample of Chinese non-financial firms listed on Shanghai Stock Exchange from 2001 to 2005, and document that directors appointed by the controlling shareholders are positively associated with minority-investor expropriation, as measured by related-party transactions.

On the other hand, the representatives from the ultimate controlling shareholders also take the role of directors with the function of monitoring. The affiliated directors have the responsibility to monitor the behaviours of the executives that may reduce firm value due to their private benefits, so that they can protect the interest of the ultimate controlling shareholders and the wealth of listed firms. Chen et al. (2014a) confirm this argument with a sample of Chinese A-share listed firms in a period from 2005 to 2011 and provide related evidence that a greater presence of board affiliation with block shareholders can reduce a company's pay gap[13]. They further distinguish board affiliation with and without pay[14] as well as the affiliated directors from controlling shareholders. The salaried affiliated directors

[13] Chen et al. (2014a) measure the company pay gap by using the relative pay between executives and employees as well as the relative pay gap between the highest paid top executive and the other top executives.
[14] Board affiliation with pay refers to the affiliated directors receiving compensation from the listed firm. In contrast, board affiliation without pay means the affiliated directors do not receive compensation from the listed firm, but from the shareholders who have appointed them.

from controlling shareholders are positively associated with the pay gap. In contrast, the non-salaried affiliated ones have a significant effect on easing the agency problem and lowering this gap. The possible reason for this is that board affiliation without pay gives more independence from the executives and thus, affiliates play a better monitoring role for ultimate controlling shareholders.

The problem becomes more serious when it comes to listed CEs, where it is crucial to monitor the executives to avoid the potential loss of state assets due to their self-dealings[15]. The affiliated directors from the central enterprises take on this duty, as they are the representative of the owner of these state assets. In addition, in listed CEs, most non-executive directors affiliated with central enterprises are non-salaried (i.e. without pay from listed CEs). Hence, these directors have less intervention from the executives and can play a better role in representing the interest of central enterprises (even the attention of the central government). Consequently, the affiliated directors from the central enterprises may improve the firm value of listed CEs. Furthermore, according to the resource dependence theory proposed by Hillman et al. (2009), the affiliated directors may bring business group internal resources and political benefits to listed CEs, which can lead to a positive effect of increasing the valuation of listed CEs.

The potential negative and positive effects on firm value caused by the affiliated directors are accepted here and thus, it is believed that having an appropriate number of affiliated directors on the corporate board will be beneficial to listed CEs. Hence, this study proposes an inverse U-shaped relationship between affiliated directors and corporate value in listed CEs and predicts that there should be a balanced structure of the corporate board in listed CEs. The hypothesis about the economic consequences of affiliated directors from the central enterprises is that:

H3: the proportion of affiliated directors appointed by central enterprises on behalf of the central government has an inverse U-shaped relationship with the firm value of listed CEs.

[15] For instance, the Central Commission for Discipline Inspection disclosed that 64 executives of CEs were inspected and punished due to corruption in 2015. http://www.ccdi.gov.cn/scdc/

3.3 Research design and data

3.3.1 Methodology and variables

(1) Determinants of affiliated directors from the ultimate owner perspective

This study first aims at examining how the central government as the ultimate owner affects the appointment of directors on the corporate board of listed CEs. As the hypotheses have developed, the cash-flow rights and the deviation of voting and cash-flow rights owned by the central government are considered key influencing factors that may affect the proportion of affiliated directors on the corporate board. Meanwhile, it is necessary to control for the other board characteristics that may have an influence on the fraction of affiliated directors on the corporate board. Also, this study controls for several firm characteristics that may be related to the appointment of affiliated directors. The modelling framework is as follows:

$$Affilliated\_directors_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1}(Separation_{i,t-1}) + \beta_2 Boardsize_{i,t-1} + \beta_3 Indepednent\_directors_{i,t-1} + \beta_4 Ceo\_duality_{i,t-1} + \beta_5 Affiliated\_chairman_{i,t-1} + \beta_6 Tobin'sQ_{i,t-1} + \beta_7 Firmsize_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 Listexg_{i,t} + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t} \quad (3.1)$$

where the dependent variable (*Affiliated_directors*) is the proportion of affiliated directors from the central enterprises or its affiliations, which is measured by their number on the corporate board scaled by the total number of board members. As the dependent variable in this study is a fraction in the range between 0 and 1, this study employs the fractional probit regression[16] to estimate the model. *Ownership* is the major independent variable, represented by the cash-flow rights owned by the central government. Another independent variable is *Separation*, showing the deviation of cash-flow from voting rights owned by the central government. *Separation* is derived from the ratio of voting and cash-

[16] This study also uses the fractional logit regression and gets analogous results.

flow rights[17] owned by the central government. Both independent variables are one-year lagged so that this can partially avoid the potential causality issue.

The existing literature shows that other board characteristics may affect the board structure as well (Yeh and Woidtke, 2005; Dahya et al., 2008; Chou et al., 2018). The first control variable is the size of the board of directors (*Boardsize*), which is the total number of directors on the corporate board. As Yeh and Woidtke (2005) find that board affiliation decreases with an increase in the number of directors on the corporate board, this study predicts that the sign of *Boardsize* is negative. The proportion of independent directors (*Independent_directors*) is measured by their number scaled by the total number of directors on the corporate board. The primary responsibility of independent directors in China is to avoid the wealth of minority shareholders being expropriated by controlling shareholders (CSRC, August,2001). Since the affiliated directors represent the interest of the ultimate controlling shareholders, these two kinds of director generally belong to opposite parties. Hence, the proportion of independent directors is added to control for their potential influence on the appointment of affiliated directors. When the CEO takes the position of the chairman on the corporate board, that person's power in the board selection process is promoted. In this case, it will motivate the CEO to place more "friendly faces" on the corporate board (Klein, 1998). This study predicts there is a significant relationship between *Ceo_duality* and *Affiliated_directors*. *Ceo_duality* is an indicator variable as to whether the CEO concurrently holds the position of chairman of the corporate board. It equals one when the chairman of the corporate board and the CEO are the same person and zero, otherwise. When the chairman on the corporate board is from central enterprises, then he/she is likely to welcome more affiliated directors from that entity or its affiliations. This chairman is much more likely to form an alliance to carry out the work and less likely to face opposition in such a working environment. In order to capture this potential effect on the fraction of affiliated directors, a dummy variable (*Affiliated_chairman*) is employed, which equals 1, if the chairman of the corporate board is appointed by the central

[17] The method used to calculate the voting and cash-flow rights of the ultimate owner is from La Porta et al. (1999) and Claessens et al. (2000). The control of the ultimate owner is represented by the voting rights, which are the sum of the weakest links in the chain of control. The ownership of the ultimate owner is represented by the cash-flow rights, which are the sum of the products of the ownership stakes along the controlling chains. Appendix 4 shows a specific example of the separation of voting and cash-flow rights.

enterprise and 0, otherwise. As it may take time for governance related variables to reflect their influence, all corporate board related control variables are one-year lagged.

This study also controls for potential influences from firm characteristics. Erickson et al. (2005) use evidence from Canada and document that board composition (i.e., the fraction of outside directors on the corporate board) harms firm value, and the low corporation value leads to a change of board structure in subsequent periods. In contrast, Dahya et al. (2008) use a cross-country sample and find that firm value does not affect the board structure; however, board composition (i.e. the proportion of independent directors[18]) does impact on firm value. Prevost et al. (2002) use a simulation equations approach with evidence from New Zealand listed firms, and report that board composition (i.e. the proportion of outsiders on the board) and firm value positively and jointly impact on each other. Hence, there is no consistent result in the relation between board composition and firm value. For this study, Tobin's Q is the proxy of firm value, which is calculated from the market value of equity and net debt over total assets. In order to control for the potential causality issue between affiliated directors and firm value as discussed in the existing literature, *Tobin's Q* is one-year lagged. The other firm characteristics controlled for in this study are: *Firmsize*, which is the natural logarithm of total assets of listed CEs. *Leverage* is calculated by total debts over total assets. *Listexg* is an indicator variable that shows the specific stock exchange that the listed CE come under. It equals 1, if they went public on the Shanghai Stock Exchange and, 0 if listed on the Shenzhen Stock Exchange. These other firm characteristic variables are in the same period with the dependent variable. [19] This study also controls for the fixed effects of industry and year in the regression model. As the listed CEs are concentrated in certain industries, this study divides them into four industries based on the *Guidance for Industry Classification of Listed Companies* (1999) released by CSRC: Utilities, Conglomerates, Industrials, and Commerce.

[18] Dahya et al. (2008) define the proportion of independent directors as the number of non-affiliated directors divided by the size of the corporate board.

[19] In this study also, the firm characteristics related variables are replaced with one-year lagged ones and a consistent result is obtained with that of the main specification shown in Equation (3.1).

(2) The effect of affiliated directors on firm value

For the second part of this study, whether affiliated directors have an impact on the subsequent firm value of listed CEs is investigated. As discussed in the previous section, the relation between affiliated directors and firm value may be non-linear. Here, the quadratic term of the proportion of affiliated directors is utilised to examine this potential curvilinear relation. In this part, this study also controls for the possible effects of the corporate board and firm related characteristics. The regression model is as follows:

$$Tobin's\ Q_{i,t+1} = \beta_0 + \beta_1 Affiliated\_directors_{i,t} + \beta_2 Affiliated\_square_{i,t} + \beta_3 Ownership_{i,t}(Separation_{i,t}) + \beta_4 Boardsize_{i,t} + \beta_5 Indepednent\_directors_{i,t} + \beta_6 Ceo\_duality_{i,t} + \beta_7 Affiliated\_chairman_{i,t} + \beta_8 Firmage_{i,t+1} + \beta_9 Firmsize_{i,t+1} + \beta_{10} Leverage_{i,t+1} + + \beta_{11} Growth_{i,t+1} + \beta_{12} Listexg_{i,t+1} + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t+1} \quad (3.2)$$

where the dependent variable (*Tobin's Q*) is the firm value of the listed CEs, which has the same definition in Equation (3.1). *Affiliated_directors* is the independent variable in this regression specification, which is measured by the proportion of affiliated directors from the central enterprise or its affiliations. *Affiliated_square* is the quadratic term of the fraction of affiliated directors on the corporate board. According to the developed hypothesis, this study expects a positive coefficient of *Affiliated_directors* and a negative coefficient of *Affiliated_square*, which represents an inverse U-shaped relation between affiliated directors and subsequent firm value for listed CEs.

The right-hand side variables in Equation (3.1) are used as the control variables in Equation (3.2), as it is widely considered that they have a relationship with firm value as well. For instance, Claessens et al. (2002) find that *Ownership* has a positive relationship with firm value, whilst *Separation* is negatively related to corporation value, which indicates the incentive alignment and entrenchment effects to firm performance, respectively. Erickson et al. (2005) find that large board size leads to lower firm value, using evidence from Canadian listed firms. In contrast, Leong et al. (2015) document *Boardsize* as being positively associated with firm value, using evidence from the Bursa Malaysia. They also argue that the

proportion of independent directors on the corporate board (*Independent_directors*) is negatively related to firm value. Bai et al. (2004) find that the CEO concurrently holding the position of the chairman on the corporate board reduces firm value, which is indicated by a sample of Chinese listed firms in a period from 1999 to 2001. In addition to the existing firm characteristics related control variables, *Firmage* and *Growth* are utilised to control for their effects on firm value (e.g. Mak and Kusnadi, 2005; Chou et al., 2018). *Firmage* is the number of years since the listed CE went public and *Growth* is growth opportunities, represented by the sales growth rate. The sales growth rate is calculated by the difference of the annual sales in this year and last year, scaled by the total sales in the last year. In line with Equation (3.1), Equation (3.2) shows a lead/lag relation to avoid the potential causality issue. In addition, in Equation (3.2), the dependent variable and firm characteristics related control variables are in year t+1, leading independent variables and corporate board related control variables by one year. In this regression model, the fixed effects of industry and year are controlled for as well. Table 3-1 provides a concise summary of each variable employed in Equations (3.1) and (3.2).

3.3.2 Data and sample selection

This study examines the willingness of the ultimate owner to place affiliated directors on the corporate board and the effect of these affiliated directors on firm value among listed CEs, with all the related information of all listed CEs being collected for the main research focal period from 2012 to 2016. As the main regressions apply a lead/lag relationship for dependent/independent variables, this study collected the data in year 2011 and 2017 of some variables as well. First, this study screened out the listed CEs according to the nature of the ultimate owner of listed firms. In 2001, CSRC regulated that it is mandatory for listed firms to disclose their ultimate owner and the ownership relation to other firms. Instead of using the threshold suggested by La Porta et al. (1999)[20], a listed firm is classified as a listed CE, if the top of the ownership tree of a listed firm is SASAC or a central enterprise and this was checked manually.

[20] La Porta et al. (1999) suggest that a firm has an ultimate owner when the direct or indirect voting rights held by this shareholder are over the threshold. In general, the cut-off point is 20%.

The affiliated director is the key variable used, and there is no consistent definition of what kind of directors on the corporate board are "affiliated". That is, studies related to different topics have their concept of affiliated directors[21]. The affiliated director in this study is the director on the corporate board affiliated with the ultimate owner, who concurrently has a position in the central enterprise or its affiliations, as shown on the ownership tree.[22] The number of affiliated directors of each listed CE was manually collected from the annual reports. The financial and other corporate board related information was obtained from the Chinese Securities Market and Accounting Research (CSMAR) database. This study dropped the listed CEs in finance and real estate industries as well as observations with negative equity. Also, this study excluded the listed CEs that go public in the current year, as CSMAR does not provide pre-IPO related financial information. Finally, there are 942 firm-year observations by 225 unique listed CEs for the main regressions.

Table 3-2 reports the descriptive statistics for the variables related to ownership structure, corporate board, and firm characteristics of listed CEs. The central government holds, on average 40%, of the cash-flow rights of listed CEs on the stock market, whilst the average voting rights owned by the central government is 45.5%. This provides evidence that the ownership of Chinese listed CEs is highly concentrated and held by the central government. Furthermore, the average voting rights exceed cash-flow rights owned by the central government, which is in line with the argument of La Porta et al. (1999) and Claessens et al. (2000), that the ultimate shareholders typically have more control rights than cash-flow rights. As the minimum values of the cash-flow rights and voting rights are 7.65% and 12.2%, respectively, the definition of the ultimate owner using the 20% of the votes rule, as recommended by La Porta et al. (1999), may not be a suitable criterion in this case. Also, these low values show that even, if the central government has a very small percentage of

[21] For instance, Klein (1998) examines the efficiency of affiliated directors, and defines them as former employees, relative of CEOs or those who have significant transactions and/or business relationships with the firm, or seat on an interlocking board. Dahya et al. (2008) discuss the effect of the dominant shareholder(s) on the corporate board, and list seven criteria to define the directors affiliated with the dominant shareholder(s). Arosa et al. (2010) test the relation between outside directors and firm performance, defining affiliated directors as those with potential or existing business relationships to the firm and who are not full-time employees.

[22] For instance, Sinopec Limited (a listed CE) is ultimately controlled by China Petrochemical Corporation Group (a CE). Sinopec Group has 71.32% ownership of its listed subsidiary. In 2016, four directors on the corporate board of Sinopec Limited concurrently have a position in Sinopec Group, therefore those four directors are named "affiliated directors". For the detailed information, please see Appendix 3.

the capital of listed firms, it still has a significant influence on the strategies and decision-making of listed firms and is disclosed by listed firms in the annual reports as the ultimate owner.

The average divergence of control and ownership is 1.256, which means the voting rights held by the central government are 1.256 times its cash-flow rights. The median value is 1, showing that less than half of listed CEs deviate their voting and cash-flow rights. On average, the listed CEs have ten members on the corporate board, 37.1% of which are independent and 37.7% are affiliated with central enterprises. Only around 6% of listed CEs have the same person in the role of the chairman and CEO; however, most listed CEs have a chairman appointed by central enterprises. For firm characteristics, listed CEs have an average Tobin's Q value of 1.98 and a leverage ratio of 52.9%, calculated by total debts over total assets. The size of the listed CEs varies from 0.31 to 2405.27 billion RMB. In addition, around 70% of listed CEs are on the Shanghai Stock Exchange. The average number of years that listed CEs have been on the stock exchange is 14, with the average sales growth rate being 11.3%.

Table 3-3 reports the Pearson correlation matrix, which is an intuitive check for multicollinearity[23]. Panel A of Table 3-3 is the correlation matrix of the proportion of affiliated directors, its potential determinant variables and the control variables. In Panel A, Table 3-3, the correlation coefficient between *Ownership* and *Control* is 0.854, which exceeds 0.7 and thus, may indicate the presence of the multicollinearity problem. However, *Control* is not a key variable included in the main regressions. The correlation coefficients among all the other variables do not have an absolute value higher than 0.7. Panel B of Table 3-3 shows the correlation matrix of variables about examining the relationship between affiliated directors and firm value in listed CEs. The absolute value of the correlation coefficients among the variables in this panel also does not exceed 0.7. Hence,

[23] Multicollinearity occurs when the correlation between or among independent variables is very high. The multicollinearity issue leads to unstable and unreliable regression estimates. Pearson correlation matrix provides the correlation coefficient among independent variables, which show the presence of multicollinearity. If the absolute value of correlation coefficient between two independent variables is over 0.7, then there exists a multicollinearity issue and one of those two independent variables must be dropped.

there is no significant multicollinearity interference among the independent and control variables.

3.4 Empirical results

3.4.1 The impact of the ultimate owner on board composition

(1) Univariate analysis

In the sample, the median of cash-flow rights held by the central government is 41.3%. This study divides the listed CEs into two groups by using 41.3% as the cut-off point. The high cash-flow group is that the listed CEs with over 41.3% cash-flow rights owned by the central government, whilst those no more than 41.3% owned by the central government are in the low ownership group. Table 3-4, Panel A shows the mean of the affiliated director ratio, the cash-flow rights as well as the wedge between control and ownership in these two groups and the difference in means. The low and high ownership groups have a similar proportion of affiliated directors on the corporate board, as the difference of the mean of affiliated directors in these two groups is not significant. Specifically, in the low ownership group, there are 38.2% of directors in the listed CEs are affiliated with central enterprises, whilst 37.2% of directors in listed CEs with high ownership are from the central enterprise or its affiliations.

The significant difference in voting rights (*Control*) in these two groups indicates that high ownership generally comes with a high degree of control. The difference of *Separation* in these two groups is significant at the level of 1%, which shows that the low ownership group has an average higher deviation of cash-flow from voting rights. Similar results are obtained, when 40% (the mean value of cash-flow rights) or 50%[24] of cash-flow rights is utilised as the alternative criterion to distinguish low and high ownership.

Table 3-4, Panel B shows the comparison of *Affiliated_directors*, *Control* and *Ownership* in the listed CEs, with and without a divergence of control and ownership. It emerges that listed CEs with a deviation of voting and cash-flow rights have more affiliated directors on

[24] 50% is the boundary of "absolute control", which means the shareholder can absolutely control this firm due to the shares he/ she owns.

the corporate board than those without such deviation. The significant evidence supports H2 that the separation of control and ownership held by the central government is positively related to the proportion of affiliated directors on the corporate board. Also, the significant difference of *Ownership* in these two groups further indicates that listed CEs with a divergence of control and ownership have relatively lower cash-flow rights of the central government.

As the univariate analysis does not control for control variables and the differences in industry and year, this study conducts multivariate tests and provides the related empirical results in the next subsection.

(2) Multivariate analysis

Table 3-5 reports the regression results testing how the central government affects board composition through the ownership structure. Column (1) indicates the relationship between cash-flow rights and the proportion of affiliated directors from the central enterprises and Column (2) displays the marginal effect of variables. The coefficient of *Ownership* is negative, but not significantly different from zero. That is, this study fails to find significant evidence that the ownership motivates the central enterprises to place fewer affiliated directors on the corporate board of listed CEs and hence, it is concluded that the cash-flow rights owned by the central government is not a significant factor that influences board affiliation in listed CEs. Column (3) displays the regression result with the deviation of cash-flow from voting rights and Column (4) reports the marginal effect of variables. The coefficient of *Separation* is positively significant at the 5% level, which implies the significant positive relationship between the divergence of voting and cashflow rights and the proportion of affiliated directors. The marginal effect of *Separation* is 3.86 percent, illustrating that a 1 percent increase in the separation of voting and cash-flow rights owned by the central government leads to a 3.86 percentage point increase in the proportion of affiliated directors on the corporate board of listed CEs. The result supports H2 that the separation of control and ownership is positively related to the proportion of affiliated directors in listed CEs. Also, this finding is in line with Yeh and Woidtke (2005) that the

wedge between control and ownership motivates the ultimate controlling shareholders to elect more affiliated directors onto the corporate board of listed firms.

For the control variables, the proportion of independent directors has a negative relation with that of affiliated directors from the central enterprise or its affiliations at the 1% level. The affiliated chairman is positively associated with the fraction of affiliated directors, as the coefficient of *Affiliated_chairman* is positively significant at the level of 1%. This indicates that if the chairman is from the central enterprise, he/she prefers more directors also being appointed by that enterprise. In addition, large listed CEs have more affiliated directors from central enterprises, being confirmed by the positive and significant relationship between firm size and the proportion of affiliated directors. A plausible reason for this, is that large listed CEs generally are in important industries and more affiliated directors are needed to ensure the effective control on these important state assets. Last, there is significant evidence that the listed CEs on the Shanghai Stock Exchange have more affiliated directors from the central enterprises.

3.4.2 The effect of affiliated directors on firm value

Table 3-6 shows the regression results examining the economic consequences of affiliated directors, especially their effect on the firm value of listed CEs. The first two columns test the potential linear relationship between affiliated directors and the corporation value of listed CEs. The insignificant coefficient of *Affiliated_directors* in Columns (1) and (2) indicates that there is no linear relationship between the proportion of such directors and firm value in listed CEs. Columns (3) and (4) illustrate the potential curvilinear relationship between affiliated directors and firm value by adding the square term of the affiliated director ratio (*Affiliated_square*) into the regressions. The coefficient of *Affiliated_director*s and *Affiliated_squar*e is significantly different from zero at the 1% level, thus indicating a curvilinear relationship between the affiliated director ratio and firm value in listed CEs. Meanwhile, the positive coefficient of *Affiliated_directors* and the negative coefficient of *Affiliated_square* show that this non-linear relationship between these two factors has an inverse U-shape. Hence, the significant evidence in this study supports H3. The average

turning point of the affiliated director ratio is 0.42[25], which provides an optimal proportion of affiliated directors that leads to the highest firm value of listed CEs in this case. In detail, more directors affiliated with the central enterprises increase the firm value of listed CEs in the subsequent period, up until the proportion of such directors on the board reaches 42%. If it exceeds the turning point, the effect of affiliated directors becomes negative, which reduces the firm value of listed CEs. This implies that too many affiliated directors on the board may not help these listed CEs perform well.

In Column (3) of Table 3-6, the coefficient of *Ownership* is positively related to firm value and significant at the 1% level, which indicates the incentive alignment effect from the ultimate owner. This supports the literature that the ultimate owner with higher cash-flow rights has an incentive effect similar to the minority shareholders and hence, is willing to increase the value of the listed firm. On the other hand, Column (4) shows that the negative coefficient of *Separation* is significantly related to firm value at the 1% level, which confirms the entrenchment effect from the ultimate owner. This indicates that the ultimate owner expropriates the benefits from minority shareholders, as they find that the private benefits that they can get from the expropriation are higher than the benefits of increasing firm value. The significant evidence in listed CEs supports the argument proposed by Claessens et al. (2002) that, under concentrated ownership, large cash-flow rights from the ultimate owner increase firm value. Moreover, when its separation of voting and cash-flow rights is significant, the firm value decreases.

For other control variables, the coefficient of *Firmsize* is negatively associated with firm value and significant at the 1% level, which illustrates that larger listed CEs have lower firm value. This result supports Chen and Ho (2000) and Campbell and Mínguez-Vera (2007), who state that the firm size has a negative influence on Tobin's Q. Also, it is found that *Leverage* has a significant negative effect on firm value, which is consistent with Erickson et al. (2005), who elicit that a higher debt to assets ratio leads to lower firm value.

[25] The turning point of affiliated directors in Column (3) is 0.419 (-2.907/ (-3.470×2)), and that in Column (4) is 0.423(-3.059/ (-3.614×2)).

3.4.3 The contemporaneous relation between affiliated directors and firm value

To reduce the endogeneity problem, in the previous subsection, the lead/lag relation model is employed to examine the relationship between affiliated directors and firm value in listed CEs. It emerges that firm value measured by Tobin's Q has no significant effect on the proportion of affiliated directors of listed CEs in the next period. In contrast, these affiliated directors have an inverse U-shaped relationship with the subsequent firm value of listed CEs. Following Durnev and Kim (2005) and Lins (2003), the simultaneous equations approach estimated by a 3SLS (three-stage least squares) method is adopted to examine the contemporaneous relation between affiliated directors and firm value. This estimation method allows for endogeneity between contemporaneous affiliated directors and firm value. However, it is necessary to figure out some exogenous variables that are only related to one of these two factors, but not have effects on both. For instance, the factors that only have effects on the proportion of affiliated directors, but not on firm value, need to be identified. As Durnev and Kim (2005) argue that it is difficult to identify the truly exogenous variables and hence, the related regression results must be interpreted with caution.

There are two equations in the simultaneous system. One uses the proportion of affiliated directors as the dependent variable, whilst this variable in the other equation is the corporation value of listed CEs, as measured by Tobin' Q.

The board affiliation equation is the same as Equation (3.1), excluding *Leverage*. This is because the result of the main regressions in Tables 3-5 and 3-6 show that *Leverage* is not related to the proportion of affiliated directors, but it is significantly associated with firm value. *Tobin's Q* is involved in this equation as a simultaneously determined variable. In addition, the board affiliation equation controls for the market risk measured by Beta. The values of Beta are derived from CSMAR, estimated by the capital assets pricing model (CAPM), with the information within the recent one year. This is in line with Durnev and Kim (2005), Lins (2003), and Demsetz and Villalonga (2001), who argue that the controlling shareholders have better opportunities to profit from inside information, when the market risk is higher. In the listed CEs, this may motivate central enterprises to place more affiliated

directors on the corporate board of listed CEs, which makes it easier for the central enterprises to obtain inside information.

In the firm value equation, *Tobin's Q* is the dependent variable, and *Affiliated_directors* and *Affiliated_square* are the simultaneously determined variables. Compared with Equation (3.2), the firm value equation drops the corporate board related variables (*Boardsize*, *Independent_directors*, *Ceo_duality* and *Affiliated_chairman*), as they have no significant effect on firm value (Table 3-6 shows the detailed results). However, the corporate board related variables such as *Independent_directors* and *Affiliated_chairman* have a significant impact on the proportion of affiliated directors (Table 3-5 addresses the related results). So, this study assumes that the corporate board related variables are more correlated to affiliated directors rather than firm value. The specification of the simultaneous equations set is that:

Board affiliation equation:

$$
\begin{aligned}
&Affilliated\_directors_{i,t} \\
&\quad = \beta_0 + \beta_1 Tobin'sQ_{i,t} + \beta_2 Ownership_{i,t}(Separation_{i,t}) + \beta_3 Boardsize_{i,t} \\
&\quad + \beta_4 Indepednent\_directors_{i,t} + \beta_5 Ceo\_duality_{i,t} \\
&\quad + \beta_6 Affiliated\_chairman_{i,t} + \beta_7 Beta_{i,t} + \beta_8 Firmsize_{i,t} + \beta_9 Listexg_{i,t} \\
&\quad + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t}
\end{aligned}
$$

Firm value equation: (3.3)

$$
\begin{aligned}
Tobin's\ Q_{i,t} = {} & \beta_0 + \beta_1 Affiliated\_directors_{i,t} + \beta_2 Affilaited\_square_{i,t} \\
& + \beta_3 Ownership_{i,t}(Separation_{i,t}) + \beta_4 Firmage_{i,t} + \beta_5 Firmsize_{i,t} \\
& + \beta_6 Leverage_{i,t} + + \beta_7 Growth_{i,t} + \beta_8 Listexg_{i,t} \\
& + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t}
\end{aligned}
$$

Table 3-7 reports the 3SLS estimation results for the contemporaneous relation between affiliated directors and firm value among listed CEs. This study obtains a relatively larger sample of 978 firm-year observations by 229 unique listed CEs due to less missing data. In the board affiliation equation, the coefficient of *Tobin's Q* is positively significant at the level of 5%, thus indicating the positive effect of firm value on the appointment of affiliated directors. In the firm value equation, the coefficient of both *Affiliated_directors* and *Affiliated_square* is significant at the level of 1%. The positive coefficient of *Affiliated_directors* and the negative coefficient of *Affiliated_square* confirm the inverse U-shaped relation between affiliated directors and firm value. This result is consistent with that in the main regressions. Overall, there is a relation between the contemporaneous affiliated director ratio and firm value, but not necessarily causation, as the contemporaneous proportion of affiliated directors and firm value in listed CEs jointly affect each other.

In addition, in the board affiliation equation, the coefficient of *Ownership* estimated by 3SLS method in Column (1) is negatively significant at the 1% level. This implies that the central enterprises prefer appointing directors based on their expertise rather than affiliation when the central government owns higher cash-flow rights of listed CEs. This result is consistent with what H1 proposes. As expected, the coefficient of *Beta* in Column (1) and (2) is positively significant at the 1% level. This indicates that the central enterprises are likely to place more affiliated representatives on the corporate board to get inside information more easily, so that they can receive abnormal profits, when the market risk is relatively high.

3.4.4 Sensitivity analysis

As this study finds a non-linear relationship between affiliated directors and firm value in listed CEs as well as an optimal proportion of affiliated directors that leads to the highest firm value, an alternative regression model (i.e. the piecewise regression model) is applied to examine the presence of this curvilinear relationship between affiliated directors and firm value. This study splits the proportion of affiliated directors into two piecewise variables, according to the turning point (0.42) found in the main regression. *Affiliated_directors (under 0.42)* equals the fraction of affiliated directors on the corporate board, when it is under 0.42. It equals 0.42 when the proportion of affiliated directors is more than 0.42. *Affiliated_directors (above 0.42)* equals 0, when the proportion of independent directors is under 0.42. It equals the affiliated director ratio minus 0.42 when the proportion of affiliated directors exceeds 0.42. If the segmented regression model can indicate the non-linear relation between affiliated directors and firm value, the coefficient of both variables should be significant at least at the level of 10%.

Table 3-8 reports the regression result of the alternative regression model testing the non-linear relationship between affiliated directors and firm value. As expected, the coefficients of these two variables are significant at least at the level of 5%. The positive coefficient of *Affiliated_directors (under 0.42)* confirms the positive effect of affiliated directors on firm value in listed CEs before their proportion reaches the turning point. The negative coefficient of *Affiliated_directors (above 0.42)* supports the negative effect of affiliated directors on firm value, when there are more than 42% of directors affiliated with the central enterprises.

Following Verbeek (2008), 3SLS provides more efficient estimates than 2SLS (two-stage least squares) does in the case that there is no misspecification in the simultaneous equations system. In order to examine the exogeneity requirement and the efficiency of the exogenous variables identified in board affiliation and firm value equations, this study adopts the 2SLS approach, with a series of related tests also being conducted. In the 2SLS estimation, the defined exogenous variables in the equation set are treated as instruments

for their dependent variable. For instance, *Leverage*, *Firmage*, and *Growth* are the exogenous variables in the firm value equation, as they have been identified as affecting firm value, but not the proportion of affiliated directors. Correspondingly, in the 2SLS approach, they are employed as the instruments of Tobin's Q.

Table 3-9 reports the results of the simultaneous equations system estimated by 2SLS. To be specific, Columns (1) and (2) show the regression results of the board affiliation equation. Columns (3) and (4) display the regression results for the firm value equation. Overall, the finding derived from the 2SLS approach is similar to that shown in Table 3-7, whereby the contemporaneous proportion of affiliated directors and firm value jointly affect each other. In addition, the result of Hansen's J test (overidentification test) in all columns is insignificant at the 10% level, which indicates the identified exogenous variables in the equation are uncorrelated with the error term. This confirms that the exogenous variables defined as instruments meet the exogeneity requirement. This study employs the Anderson-Rubin Wald test and Stock-Wright LM test to examine whether the identified exogenous variables are weak instruments. As shown in Table 3-9, the value of the χ^2 of these two tests in each column is at least significant at the 5% level, thus illustrating sufficient correlation of the defined exogenous variables with the identified endogenous variable. Hence, the 2SLS approach confirms the appropriate identification of the exogeneous variables in the simultaneous equations system.

3.5 Extended tests

3.5.1 The effect of external mechanisms on affiliated directors and firm value

In the main regressions, it is found that a significant separation of control and ownership motivates the central enterprises to place more affiliated directors on the corporate board in the next period. Furthermore, too many of affiliated directors on the corporate board (for example, in this research sample, more than 42% of directors are affiliated with the central enterprises) is negatively associated with the subsequent corporation value of listed CEs. This section conducts additional tests to examine the potential external mechanisms that affect the relationship between affiliated directors and firm value in listed CEs.

The first potential influencing factor is the quality of external auditors. Fan and Wong (2005) examine the governance role of external auditors in eight East Asian economies with concentrated ownership for the period from 1994 to 1996. They find that listed firms with the agency problem due to the ownership structure[26] are more likely to choose the external auditor from the big five accounting firms[27] and this relation is evident among firms that raise capital equity frequently. The appointment of the big five auditors marginally mitigates the stock price discount associated with agency problems induced by the ownership structure. They conclude that the external auditor is an effective mechanism to reduce agency theory problems due to the ownership structure in emerging markets. Zerni et al. (2010) confirm that high quality audit can mitigate the negative entrenchment effect of controlling shareholders on firm value, using evidence from Sweden. Also, Eshleman and Guo (2014) find that the big four accounting firms do provide better audit quality, after controlling for the endogenous choice of auditors. Hence, this study divides the listed CEs into two groups based on whether they are the client of the big four. The regression model

[26] In the study of Fan and Wong (2005), they use the wedge between control and ownership owned by the controlling shareholder as an indicator of the agency conflict between the controlling shareholders and minority shareholders.

[27] There were the big five accounting firms during the research period of the study conducted by Fan and Wong (2005), which were EY, Deloitte, Arthur Andersen, KPMG, and PWC. However, Arthur Andersen was bankrupted in 2002 due to the 2001 Enron scandal.

(Equation (3.2)) is enlisted to examine the relation between affiliated directors and firm value of listed CEs again.

Table 3-10 shows the results. It emerges that 17.52% of observations are the client of the big four accounting firms, whilst 82.28% of them choose non-big four (such as local accounting firms) as their external auditor. It shows that most listed CEs are more likely to select non-big four or even local accounting firms, which is probably due to the relatively higher costs of the big four. Columns (1) and (2) display the relationship between affiliated directors and firm value in the group that does not hire the big four as its external auditor. The results are consistent with those in the main regressions that affiliated directors have an inverse U-shaped relation with the subsequent corporation value of listed CEs. The average turning point of affiliated directors is 0.43, which is similar to that (0.42) found in Table 3-5. Columns (3) and (4) report the results of the group with the big four as their external auditor. The coefficient of *Affiliated_square* in both columns is insignificant, while the coefficient of *Affiliated_directors* in Column (3) is close to the significant marginal level and that in Column (4) is significant at the level of 10%. It means that in the group with the big four, the affiliated directors from the central enterprises do not have a significant and negative effect on firm value in listed CEs. The big four accounting firms generally care more about their reputation in the market and have better quality auditors. They bring more pressures on listed CEs, which constrains the behaviours of affiliated directors. Under the external monitoring from the big four, they are less likely to engage in expropriation from the listed firm even though they dominant the corporate board. This result provides further evidence that the external auditor plays an active governance role in mitigating the negative entrenchment effect from the ultimate owner.

The second potential influencing factor is the presence of foreign institutional shareholders. Gillan and Starks (2003) argue that foreign institutional investors have the crucial role of improving the corporate governance of listed firms. Ferreira and Matos (2008) investigate the role of institutional investors around the world for the year 2000 through to 2005. They find that the listed firms with higher ownership held by foreign institutions have higher corporation value. Aggarwal et al. (2011) also employ a worldwide sample consisting of 23

countries in a period from 2003 to 2008 and document that firm-level governance is positively associated with the foreign institutional shareholdings. Chen et al. (2017) discuss the function of foreign institutional investors on the investment efficiency of newly privatised firms from 64 countries. They find that the foreign institutional shareholdings have a positive effect on improving the investment efficiency of listed firms, which is different from state ownership, where a negative impact is found. Huang and Zhu (2015) use evidence from China under its split-share structure reform that floats non-tradable shares[28] and they report that the participation of foreign institutional investors can significantly reduce the expropriation conducted by controlling shareholders in emerging markets. Accordingly, in this study, whether the presence of foreign institutional shareholdings affects the relationship between affiliated directors and the firm value of listed CEs is investigated. This study divides observations into two groups according to the listed CEs having a foreign institutional investor or not and then, the main regression (Equation (3.2)) is repeated for each group separately.

Table 3-11 displays the results that examine the effect of the presence of foreign institutional investors on the relationship between affiliated directors and firm value in listed CEs. It shows that 14.65% of observations have foreign institutional investors, whilst the rest do not. It shows that foreign institutional ownership is still not common among listed CEs. As expected, the results in Columns (1) and (2) are consistent with those in the main regressions that affiliated directors have an inverse U-shaped relation with the subsequent corporation value of listed CEs. However, there is no significant evidence of the effect of the presence of foreign institutional shareholdings in listed CEs, as an inverse U-shaped relation between affiliated directors and firm value is found in the group with foreign institutional shareholdings as well. This is indicated by the positive coefficient of *Affiliated_directors* and the negative coefficient of *Affiliated_square* in both Columns (3) and (4) being significant at the level of 5%. Hence, the foreign institutional shareholdings have no impact on the relation between affiliated directors and the subsequent firm value of listed CEs.

[28] The Chinese government launched sustained reform to transform non-tradable shares into tradable A-shares in 2005.

3.5.2 Excess board seats control and firm value

Many studies use the voting rights as a proxy for the control power from the ultimate owner (e.g. Claessens et al., 2002; La Porta et al., 2002; and Yeh, 2005). Young et al. (2007) suggest an alternative proxy, which is the board seats control rights. They argue that selecting affiliated directors for the corporate board is an essential method for the ultimate owner to strengthen the control over a listed firm, who achieves operating control of listed firms through these affiliated members. Some literature highlights that the excess control of the ultimate owner measured by the divergence of voting and cash-flow rights is negatively related to corporation value (Claessens et al., 2002; Yeh, 2005). In line with this, Young et al. (2007) find a negative effect of excess control through the corporate board as well. In their study, the excess board seats control is defined as the difference of the board seats control rights and cash-flow rights (i.e. the proportion of affiliated directors on the corporate board minus the cash-flow rights held by the controlling shareholders). They provide significant evidence that higher excess board seats control leads to a higher possibility of financial restatements, using a sample of Taiwanese listed firms for a period from 1996 to 2004. Tsai et al. (2010) also use evidence from Taiwan and find that excess board seats control has a negative impact on the market value of corporate diversification. Hence, this alternative measure of the excess control of the ultimate owner is utilised to examine the effect of the excess board seats control on firm value in listed CEs. The regression model used to test the related issue is specified below:

$$Tobin's\ Q_{i,t+1} = \beta_0 + \beta_1 Excess\_board\_seats\_control_{i,t} + \beta_2 Boardsize_{i,t} + \beta_3 Indepednent\_directors_{i,t} + \beta_4 Ceo\_duality_{i,t} + \beta_5 Affiliated\_chairman_{i,t} + \beta_6 Firmage_{i,t+1} + \beta_7 Firmsize_{i,t+1} + \beta_8 Leverage_{i,t+1} + +\beta_9 Growth_{i,t+1} + \beta_{10} Listexg_{i,t+1} + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t+1} \quad (3.4)$$

where *Excess_board_seats_control* represents the divergence of board seats control and ownership, with three measures of this variable being employed. Similar to Young et al. (2007) and Tsai et al. (2010), the excess board seats control is calculated by the proportion of affiliated directors minus the cash-flow rights held by the central government and other two alternative measures are employed. One is using the ratio of board affiliation and

ownership, which is calculated by the proportion of affiliated directors divided by the cash-flow rights. Another is a dummy variable that distinguishes the presence of excess board seats control on listed CEs. It equals 1, if the proportion of directors affiliated with central enterprises exceeds the cash-flow rights owned by the central government and 0, otherwise. Similar to Equation (3.2), the independent variable and other corporate board related control variables are one-year lagged of the firm value of listed CEs. While, the firm characteristic related variables are contemporaneous with the dependent variable (*Tobin's Q*). This regression model also controls for the fixed effects of industry and year.

Table 3-12 shows the regression results. The measures of the excess board seats control from the central enterprises provide consistent significant evidence that the excess control of these enterprises through the corporate board is negatively associated with the firm value of listed CEs. This is indicated by the coefficient of *Excess_board_seats_control* in all the columns being negative and significant at the 5% level. This implies that, in addition to too many affiliated directors on the corporate board, the proportion of affiliated directors exceeding the equity stake owned by the central government brings a negative effect on firm value. Hence, the central government needs to continue the central enterprise reform by further expanding the autonomy of management among listed CEs.

This study also examines whether the quality of external auditors and the presence of foreign institutional investors have an influence on the relation between the excess board seats control and firm value in listed CEs. Following the same approach employed in subsection 3.5.1, this study divides observations into groups with or without the big four accounting firms as their external auditor. Then, the regression is repeated regarding the relationship between the excess board seats control and firm value (Equation (3.4)) in these two groups separately. The presence of foreign institutional investors is dealt with in the same way.

Table 3-13 reports the empirical results. In Panel A, the excess board seats control in listed CEs that are the client of the big four accounting companies is positively related to firm value. While the excess board seats control is negatively associated with the firm value in

the group without the big four as the external auditor, which is consistent with the result found in Table 3-10. This implies that the quality of the external auditor does affect improving corporate governance in listed CEs, as it mitigates the negative effect of the proportion of affiliated directors exceeding the cash-flow rights owned by the central government. In addition, a similar result emerges for the presence of foreign institutional shareholdings, which is displayed in Panel B of Table 3-13. The coefficient of *Excess_board_seats_control* in the group without foreign investors is negative and significant, at least at the 5% level. However, in the group with the presence of foreign investors, the coefficient of *Excess_board_seats_control* is positive and insignificant. It shows that, whilst the foreign institutional shareholdings have no impact on the negative effect of too many affiliated directors on firm value, it can mitigate the negative effect of the excess board seats control from the central enterprises on firm value in listed CEs.

3.6 Discussion

This study examines the board structure from the ultimate owner perspective as well as the effect of the board structure on the firm value of listed CEs, by using a sample of Chinese non-financial A-share listed CEs for the years 2012 through to 2016. The proportion of affiliated directors is the measure of the corporate board structure, as the directors affiliated with central enterprises can reflect the effect of the ultimate owner directly. The results show that ownership (cash-flow rights) held by the central government has no significant impact as a determinant of the proportion of affiliated directors on the corporate board. While the separation of control and ownership motivates the central enterprises to place more affiliated directors on the corporate board in the next period. For the economic consequences of affiliated directors, there is an inverse U-shaped relation between affiliated directors and the subsequent firm value of listed CEs. This means that having more affiliated directors on the board is positively associated with the subsequent firm value of listed CEs, when the proportion of affiliated directors on the board does not exceed the moderate level. However, when more than the moderate proportion of directors on the corporate board are from the central enterprise or its affiliations, having additional ones brings a negative effect to firm value in the next period. This study tests the contemporaneous relation between affiliated directors and firm value in listed CEs, using the 3SLS approach. The contemporaneous affiliated directors and firm value jointly affect each other. Hence, the contemporaneous relation between these two factors is not causation.

This study also conducts two related additional tests and it has been discovered that the external auditor is an effective mechanism that can constrain the negative effect of too many affiliated directors on firm value, while the presence of foreign institutional investors does not influence the relation between affiliated directors and the firm value of listed CEs. Finally, by using the excess board seats control as a proxy for the separation of control and ownership by the ultimate owner, this study has found that the excess board seats control reduces the next period firm value of listed CEs. Moreover, it has emerged that external audit and the presence of foreign institutional investors could mitigate the negative effect of the excess control power from the central enterprises on firm value among listed CEs.

This study has provided new insights on the determinants of board structures from the ultimate owner perspective. The affiliated directors do have benefits on firm value of listed CEs, but too many on the corporate board lead to lower firm value. A moderate proportion of affiliated directors on the corporate board of listed CEs has implications for the state and policy-makers in terms of improving the corporate governance structure in listed CEs and even in all Chinese listed firms. To separate the central government from businesses, it is necessary to limit the board seats owned by the central enterprise or its affiliations, and to control the proportion of affiliated directors to a certain level. Also, the restriction of the proportion of affiliated directors could provide more board space for directors from other parties, which would lead to better corporate governance in listed CEs. In such an environment, the listed CEs could run more efficiently and profitably. Overall, this study enhances the understanding of the determinants of affiliated directors and their economic consequences.

Table 3-1 Summary of variable definitions

	Variables	Variable description
Ownership variables	Ownership	The cash-flow rights owned by the central government.
	Control	The voting rights held by the central government.
	Separation	The divergence of control and ownership = the voting rights / cash-flow rights owned by the central government.
Board variables	Affiliated_directors	The ratio of directors concurrently having a position in the central enterprise or its affiliations to the total number of directors.
	Affiliated_square	The quadratic term of the proportion of affiliated directors on the corporate board.
	Boardsize	Total number of directors on the corporate board.
	Independent_directors	The ratio of independent directors to the total number of directors on the corporate board.
	Ceo_duality	A dummy variable that equals 1, if the CEO also holds the position of the chairman of the corporate board and 0, otherwise.
	Affiliated_chairman	An indicator variable that equals 1, when the chairman of listed CE is from the central enterprise or its affiliations, and 0, otherwise.
Firm characteristics variables	Tobin's Q	The firm value of listed CEs, the market value of equity and net debt divided by the book value of total assets.
	Firmsize	The natural logarithm of total assets.
	Leverage	The ratio of total debt to total assets.
	Listexg	An indicator variable that equals 1, if the listed CE is on the Shanghai Stock Exchange and equals 0, if it is listed on the Shenzhen Stock Exchange.
	Firmage	The number of years since the listed CE went on public.
	Growth	Growth opportunities, the sales growth rate. The sales growth rate is calculated by the difference of the annual sales in this year and last year, scaled by the total sales in the last year.

This table shows the definition of variables employed in the main regressions. The data on affiliated directors is manually collected from the annual reports of listed CEs, whilst other governance, ownership and accounting variables are collected from CSMAR.

Table 3-2 Descriptive statistics of the variables

Variable	Obs	Mean	Std	Min	Median	Max
Ownership structure						
Ownership	942	0.400	0.160	0.0765	0.413	0.865
Control	942	0.455	0.136	0.122	0.462	0.865
Separation	942	1.256	0.513	1	1	4.782
Board of directors						
Affiliated_directors	942	0.377	0.144	0	0.375	0.692
Boardsize	942	9.400	1.934	5	9	16
Independent_directors	942	0.371	0.0604	0.231	0.333	0.714
Ceo_duality	942	0.0605	0.239	0	0	1
Affiliated_chairman	942	0.854	0.354	0	1	1
Firm characteristics						
Tobin's Q	942	1.983	1.239	0.219	1.586	11.423
Firmsize (billion/RMB)	942	56.630	209.809	0.307	8.597	2405.265
Leverage	942	0.529	0.195	0.0188	0.548	0.979
Listexg	942	0.702	0.458	0	1	1
Firmage	942	14.206	4.628	1	15	24
Growth	942	0.113	0.590	-0.776	0.039456	7.161

Table 3-2 reports the descriptive statistics of the main variables for the years 2012 to 2016.

Table 3-3 Correlation matrix

Panel A: Correlation matrix of variables in the regression about determinants of affiliated directors

		1	2	3	4	5	6	7	8	9	10	11	12
1	Affiliated_directors	1											
2	Ownership	0.003	1										
3	Control	0.076**	0.854***	1									
4	Separation	0.114***	-0.582***	-0.152***	1								
5	Boardsize	0.059*	0.096***	0.124***	-0.041	1							
6	Independent_directors	-0.152***	0.143***	0.081**	-0.118***	-0.293***	1						
7	Ceo_duality	-0.133***	-0.032	-0.038	-0.033	-0.099***	0.173***	1					
8	Affiliated_chairman	0.293***	0.049	0.102***	0.076**	0.026	-0.096***	-0.272***	1				
9	Tobin's Q	-0.002	-0.088***	-0.149***	-0.057*	-0.166***	-0.056*	-0.018	0.004	1			
10	Firmsize	0.064**	0.415***	0.439***	-0.091***	0.322***	0.153***	-0.086***	0.064*	-0.513***	1		
11	Leverage	-0.043	0.044	0.033	-0.016	0.192***	0.008	0.001	-0.026	-0.531***	0.438***	1	
12	Listexg	0.083**	0.255***	0.221***	-0.134***	0.169***	-0.051	0.003	-0.019	-0.006	0.152***	0.058*	1
	N	942											

Panel B: Correlation matrix of variables in the regression about affiliated directors and firm value

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Tobin's Q	1												
2	Affiliated_directors	0.025	1											
3	Ownership	-0.093***	0.013	1										
4	Separation	-0.065**	0.094***	-0.582***	1									
5	Boardsize	-0.164***	0.046	0.084***	-0.042	1								
6	Independent_directors	-0.073**	-0.153***	0.144***	-0.122***	-0.321***	1							
7	Ceo_duality	-0.012	-0.128***	-0.078**	-0.015	-0.101***	0.158***	1						
8	Affiliated_chairman	0.015	0.376***	0.047	0.072**	0.036	-0.066**	-0.247***	1					
9	Firmage	0.087***	0.003	-0.354***	0.179***	-0.138***	-0.116***	-0.003	-0.032	1				
10	Firmsize	-0.595***	0.066**	0.409***	-0.099***	0.313***	0.133***	-0.076**	0.076**	-0.192***	1			
11	Leverage	-0.426***	-0.059*	0.041	-0.042	0.207***	0.001	0.006	-0.036	-0.014	0.431***	1		
12	Growth	-0.032	0.023	-0.043	0.005	-0.014	0.045	0.018	-0.030	0.060*	0.029	0.015	1	
13	Listexg	-0.00095	0.083**	0.258***	-0.136***	0.175***	-0.063*	-0.049	-0.014	-0.396***	0.155***	0.048	-0.021	1
	N	942												

Table 3-3 displays the correlations for the dependent and independent variables. For a description of the variables, please refer to Table 3-1. *** p<0.01, ** p<0.05, * p<0.1.

Table 3-4 Univariate analysis

Panel A: Comparison between listed CEs with low and high ownership owned by the central government

VARIABLES	Low ownership Mean (Stand. Dev.) N=471	High ownership Mean (Stand. Dev.) N=471	Difference in means
Affiliated_directors	0.382	0.372	0.001
	(0.144)	(0.145)	
Control	0.364	0.546	-0.182***
	(0.109)	(0.092)	
Separation	1.485	1.027	0.458***
	(0.645)	(0.082)	

Panel B: Comparison between listed CEs with and without a wedge between control and ownership from the central government

VARIABLES	Separation_dummy=0 Mean (Stand. Dev.) N=563	Separation_dummy=1 Mean (Stand. Dev.) N=379	Difference in means
Affiliated_directors	0.368	0.39	-0.021***
	(0.149)	(0.136)	
Control	0.456	0.454	0.003
	(0.146)	(0.120)	
Ownership	0.456	0.318	0.139***
	(0.149)	(0.143)	

Panel A shows the measures of affiliated directors, ownership, and the separation of control and ownership, respectively, for listed CEs with low and high ownership held by the central government. *Low ownership* shows the central government has 41.3% or less cash-flow rights of listed CEs, while, *High ownership* indicates that it holds more than 41.3% cash-flow rights of listed CEs.

Panel B reports the measures of affiliated directors, ownership and control for listed CEs with or without the voting rights being different from the cash-flow rights held by the central government. *Separation_dummy* equals 1, if the central government has different voting and cash-flow rights to listed CEs and equals 0, otherwise.

For a description of the variables, please refer to Table 3-1.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3-5 The impact of the central government on the appointment of affiliated directors

VARIABLES	Dependent variable (Affiliated_directors)			
	(1)	(2)	(3)	(4)
	Coefficient	Marginal effect	Coefficient	Marginal effect
Ownership	-0.146	-0.0221		
	(0.137)			
Separation			0.082**	0.0386
			(0.039)	
Boardsize	-0.007	-0.0254	-0.006	-0.0211
	(0.012)		(0.012)	
Independent_directors	-0.908***	-0.126	-0.866***	-0.120
	(0.302)		(0.301)	
Ceo_duality	-0.063	-0.00131	-0.062	-0.00129
	(0.084)		(0.086)	
Affiliated_chairman	0.322***	0.109	0.311***	0.105
	(0.058)		(0.060)	
Tobin's Q	0.013	0.00696	0.016	0.00847
	(0.015)		(0.015)	
Firmsize	0.039**	0.0686	0.034**	0.0606
	(0.017)		(0.017)	
Leverage	-0.158	-0.0314	-0.138	-0.0274
	(0.119)		(0.119)	
Listexg	0.078*	0.0207	0.078*	0.0207
	(0.044)		(0.042)	
Constant	-0.292	-0.0221	-0.462**	0.0386
	(0.207)		(0.209)	
Industry FE	YES		YES	
Year FE	YES		YES	
Observations	942		942	
Wald Chi-squared Test	94.64***		101.3***	
Log Pseudolikelihood	-618.6		-618.2	
Pseudo R-squared	0.009		0.010	
Cluster	Firm		Firm	

The table reports fractional probit regression results with the fixed effect of industry and year.
For a description of the variables, please refer to Table 3-1.
The standard errors are clustered by firm and shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3-6 The effect of affiliated directors on firm value

	Dependent variable (Tobin's Q)			
	Linear relationship		Non-linear relationship	
VARIABLES	(1)	(2)	(3)	(4)
Affiliated_directors	0.296	0.340	2.907***	3.059***
	(0.284)	(0.288)	(1.057)	(1.068)
Affiliated_square			-3.470***	-3.614***
			(1.318)	(1.330)
Ownership	1.170***		1.154***	
	(0.335)		(0.333)	
Separation		-0.303***		-0.303***
		(0.093)		(0.092)
Boardsize	0.038	0.030	0.034	0.026
	(0.025)	(0.025)	(0.025)	(0.025)
Independent_directors	0.628	0.542	0.558	0.466
	(0.672)	(0.684)	(0.675)	(0.681)
Ceo_duality	-0.177	-0.210	-0.174	-0.206
	(0.142)	(0.145)	(0.140)	(0.141)
Affiliated_chairman	0.093	0.118	0.053	0.077
	(0.126)	(0.128)	(0.126)	(0.129)
Firmage	0.009	0.004	0.009	0.004
	(0.012)	(0.012)	(0.012)	(0.012)
Firmsize	-0.495***	-0.451***	-0.488***	-0.445***
	(0.044)	(0.042)	(0.044)	(0.041)
Leverage	-1.088***	-1.216***	-1.086***	-1.211***
	(0.302)	(0.291)	(0.300)	(0.288)
Growth	0.023	0.011	0.018	0.006
	(0.047)	(0.047)	(0.046)	(0.045)
Listexg	0.178	0.197	0.188	0.208
	(0.129)	(0.131)	(0.128)	(0.130)
Constant	3.472***	4.316***	3.124***	3.947***
	(0.558)	(0.572)	(0.526)	(0.537)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	942	942	942	942
Adjusted R-squared	0.470	0.468	0.474	0.473
Cluster	Firm	Firm	Firm	Firm

The table reports OLS regression results with the fixed effect of industry and year.
For a description of the other variables, please refer to Table 3-1.
The standard errors are clustered by firm and shown in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3-7 The contemporaneous relation estimated by 3SLS

	Dependent variable (Affiliated_directors)		Dependent variable (Tobin's Q)	
VARIABLES	(1)	(2)	(3)	(4)
Affiliated_directors			26.41***	26.17***
			(9.126)	(9.060)
Affiliated_square			-37.11***	-36.43***
			(13.280)	(13.250)
Tobin's Q	0.075**	0.063**		
	(0.030)	(0.026)		
Ownership	-0.109**		0.772**	
	(0.048)		(0.331)	
Separation		0.044***		-0.235**
		(0.012)		(0.093)
Boardsize	-0.007**	-0.005*		
	(0.003)	(0.003)		
Independent_directors	-0.414***	-0.378***		
	(0.090)	(0.086)		
Ceo_duality	-0.000238	-0.000291		
	(0.022)	(0.021)		
Affiliated_chairman	0.130***	0.126***		
	(0.015)	(0.015)		
Beta	0.056***	0.053***		
	(0.021)	(0.020)		
Firmsize	0.051***	0.041***	-0.425***	-0.400***
	(0.018)	(0.014)	(0.043)	(0.038)
Listexg	0.015	0.018	0.354***	0.351***
	(0.012)	(0.012)	(0.125)	(0.124)
Firmage			0.002	-0.000391
			(0.011)	(0.011)
Leverage			-0.886***	-0.950***
			(0.248)	(0.243)
Growth			-0.011	-0.005
			(0.070)	(0.070)
Constant	0.097	0.042	-0.654	-0.116
	(0.117)	(0.121)	(1.479)	(1.533)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	978	978	978	978
χ^2 statistics	173.59	461.75	194.97	413.86

Table reports the results of the relation between affiliated directors and firm value of listed CEs, estimated by the three-stage least square (3SLS) regression model. The dependent variable of Columns (1) and (2) is the proportion of affiliated directors (*Affiliated_directors*). The dependent variable of Columns (3) and (4) is the corporation value of listed CEs represented by Tobin's Q. *Beta* is the market risk, derived from CSMAR. It is estimated by the CAPM model with the recent 1-year data.

For a description of other variables, please refer to Table 3-1.

R^2 is not reported, as it has no statistical meaning in the case of 3SLS estimation method.

The standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3-8 The non-linear relationship examined by the alternative regression model

	Dependent variable (Tobin's Q)	
VARIABLES	(1)	(2)
Affiliated_directors (under 0.42)	1.317**	1.415***
	(0.526)	(0.532)
Affiliated_directors (above 0.42)	-1.402**	-1.449**
	(0.640)	(0.646)
Ownership	1.131***	
	(0.330)	
Separation		-0.300***
		(0.091)
Boardsize	0.034	0.026
	(0.024)	(0.025)
Independent_directors	0.548	0.454
	(0.672)	(0.678)
Ceo_duality	-0.161	-0.192
	(0.138)	(0.140)
Affiliated_chairman	0.057	0.080
	(0.125)	(0.128)
Firmage	0.0088	0.004
	(0.012)	(0.012)
Firmsize	-0.486***	-0.443***
	(0.043)	(0.040)
Leverage	-1.085***	-1.208***
	(0.298)	(0.286)
Growth	0.017	0.005
	(0.045)	(0.045)
Listexg	0.193	0.211
	(0.127)	(0.128)
Constant	3.260***	4.074***
	(0.528)	(0.536)
Industry FE	YES	YES
Year FE	YES	YES
Observations	942	942
Adjusted R-squared	0.476	0.475
Cluster	Firm	Firm

This table reports OLS results of the piecewise linear regression model with fixed effects of industry and year. *Affiliated_directors (under 0.42)* equals the proportion of affiliated directors, when it is under 0.42, and it equals 0.42, when otherwise. *Affiliated_directors (above 0.42)* equals 0, when it is under 0.42, and equals the proportion of affiliated directors minus 0.42, when it is over 0.42.
For a description of the other variables, please refer to Table 3-1.
The standard errors are clustered by firm, which is shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 3-9 The contemporaneous relation examined by 2SLS

	Dependent variable (Affiliated_directors)		Dependent variable (Tobin's Q)	
VARIABLES	(1)	(2)	(3)	(4)
Affiliated_directors			26.14***	25.91***
			(8.589)	(8.587)
Affiliated_square			-36.71***	-36.04***
			(12.320)	(12.360)
Tobin's Q	0.075**	0.063**		
	(0.031)	(0.026)		
Ownership	-0.109**		0.759**	
	(0.048)		(0.312)	
Separation		0.044***		-0.234***
		(0.013)		(0.087)
Boardsize	-0.007**	-0.005*		
	(0.003)	(0.003)		
Independent_directors	-0.403***	-0.369***		
	(0.082)	(0.080)		
Ceo_duality	0.005	0.004		
	(0.023)	(0.023)		
Affiliated_chairman	0.131***	0.127***		
	(0.015)	(0.015)		
Beta	0.061**	0.057**		
	(0.025)	(0.024)		
Firmsize	0.052***	0.042***	-0.426***	-0.402***
	(0.018)	(0.015)	(0.039)	(0.035)
Listexg	0.015	0.018	0.343***	0.340***
	(0.012)	(0.011)	(0.123)	(0.122)
Firmage			-0.00053	-0.003
			(0.011)	(0.011)
Leverage			-0.889***	-0.948***
			(0.273)	(0.271)
Growth			-0.009	-0.002
			(0.068)	(0.066)
Constant	0.082	0.028	-0.567	-0.039
	(0.120)	(0.124)	(1.408)	(1.464)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	978	978	978	978
Hansen J statistics (χ^2)	1.363	1.598	5.543	6.205
Anderson-Rubin Wald test	9.60	8.98	27	30.11
Stock-Wright LM test	9.91	9.25	41.34	43.95

The table reports the results of the relation between affiliated directors and firm value in listed CEs, estimated by the two-stage least square (2SLS) regression model. The dependent variable of Columns (1) and (2) is the proportion of affiliated directors (*Affiliated_directors*). Also, the dependent variable in Columns (3) and (4) is the corporation value of listed CEs represented by Tobin's Q. *Beta* is the market risk, derived from the CSMAR. It is estimated by the CAPM model with the recent 1-year data.
For a description of the other variables, please refer to Table 3-1.
R^2 is not reported, as it has no statistical meaning in the case of 2SLS/IV estimation method.
The robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3-10 The relation between affiliated directors and firm value in groups with and without the big 4

	Dependent variable (Tobin's Q)			
	Big 4=0		Big 4=1	
VARIABLES	(1)	(2)	(3)	(4)
Affiliated_directors	2.779**	3.007***	2.393	2.768*
	(1.141)	(1.152)	(1.447)	(1.385)
Affiliated_square	-3.195**	-3.477**	-2.475	-3.112
	(1.434)	(1.444)	(1.969)	(1.895)
Ownership	1.225***		-1.225*	
	(0.346)		(0.657)	
Separation		-0.364***		0.197
		(0.099)		(0.161)
Boardsize	0.031	0.020	0.037*	0.046**
	(0.032)	(0.033)	(0.020)	(0.017)
Independent_directors	0.515	0.388	1.067	1.017
	(0.745)	(0.757)	(0.834)	(0.839)
Ceo_duality	-0.224	-0.275*	0.157	0.200
	(0.164)	(0.164)	(0.195)	(0.180)
Affiliated_chairman	0.048	0.0777	-0.104	-0.175
	(0.137)	(0.141)	(0.200)	(0.206)
Firmage	0.013	0.006	-0.007	-0.011
	(0.015)	(0.014)	(0.014)	(0.014)
Firmsize	-0.589***	-0.549***	-0.108	-0.184***
	(0.056)	(0.054)	(0.068)	(0.050)
Leverage	-0.870***	-0.949***	-1.381***	-1.122***
	(0.329)	(0.314)	(0.449)	(0.371)
Growth	0.010	-0.003	0.151	0.180*
	(0.047)	(0.047)	(0.098)	(0.104)
Listexg	0.192	0.207	0.111	-0.000519
	(0.137)	(0.137)	(0.241)	(0.217)
Constant	3.396***	4.368***	2.233***	1.857***
	(0.594)	(0.610)	(0.604)	(0.637)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	777	777	165	165
Adjusted R-squared	0.477	0.478	0.516	0.503
Cluster	Firm	Firm	Firm	Firm

Table reports OLS results of the relation between affiliated directors and firm value of listed CEs in groups with and without the big 4.

Big 4 is an indicator variable, which equals 1 if the listed CEs hire the big 4 as their external auditor, and 0 if otherwise.

For a description of other variables, please refer to Table 3-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3-11 The relation between affiliated directors and firm value in groups with or without foreign institutional investors

	Dependent variable (Tobin's Q)			
	Foreign_investor=0		Foreign_investor=1	
VARIABLES	(1)	(2)	(3)	(4)
Affiliated_directors	2.704**	2.894***	5.302**	5.326**
	(1.091)	(1.113)	(2.099)	(2.144)
Affiliated_square	-3.207**	-3.375**	-6.368**	-6.393**
	(1.388)	(1.410)	(2.615)	(2.659)
Ownership	1.193***		0.074	
	(0.339)		(0.643)	
Separation		-0.337***		0.002
		(0.098)		(0.147)
Boardsize	0.047*	0.037	0.015	0.016
	(0.026)	(0.026)	(0.038)	(0.038)
Independent_directors	0.563	0.469	0.713	0.737
	(0.747)	(0.762)	(0.820)	(0.821)
Ceo_duality	-0.185	-0.217	0.094	0.093
	(0.151)	(0.153)	(0.208)	(0.210)
Affiliated_chairman	0.064	0.094	-0.015	-0.017
	(0.134)	(0.137)	(0.231)	(0.236)
Firmage	0.015	0.009	-0.050**	-0.051**
	(0.013)	(0.013)	(0.020)	(0.020)
Firmsize	-0.519***	-0.482***	-0.331***	-0.327***
	(0.047)	(0.045)	(0.067)	(0.046)
Leverage	-1.022***	-1.119***	-1.431***	-1.442***
	(0.322)	(0.307)	(0.472)	(0.401)
Growth	0.013	0.000585	0.327	0.322
	(0.047)	(0.046)	(0.200)	(0.198)
Listexg	0.179	0.189	0.197	0.204
	(0.139)	(0.138)	(0.166)	(0.174)
Constant	3.035***	3.943***	3.496***	3.503***
	(0.563)	(0.583)	(0.836)	(0.852)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	804	804	137	137
Adjusted R-squared	0.479	0.480	0.459	0.458
Cluster	Firm	Firm	Firm	Firm

Table reports OLS results of the relation between affiliated directors and the firm value of listed CEs in groups with and without foreign institutional investors. *Foreign_investor* is an indicator variable that, it equals 1 if the listed CEs have foreign institutional investors, and 0 if otherwise. The description of other variables refers to Table 3-1. One singleton observation in the group with foreign institutional investors is dropped (Correia, 2015).

For a description of other variables, please refer to Table 3-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3-12 The effect of excess board seats control on firm value

	Dependent variable (Tobin's Q)		
VARIABLES	(1)	(2)	(3)
Excess_board_seats_control_ratio	-0.117**		
	(0.049)		
Excess_board_seats_control_difference		-0.456**	
		(0.212)	
Excess_board_seats_control_dummy			-0.264**
			(0.106)
Boardsize	0.030	0.033	0.034
	(0.026)	(0.026)	(0.026)
Independent_directors	0.539	0.495	0.622
	(0.677)	(0.687)	(0.677)
Ceo_duality	-0.226	-0.208	-0.224
	(0.138)	(0.137)	(0.139)
Affiliated_chairman	0.192	0.200	0.194
	(0.128)	(0.130)	(0.127)
Firmage	0.005	0.005	0.005
	(0.012)	(0.013)	(0.012)
Firmsize	-0.454***	-0.459***	-0.462***
	(0.042)	(0.042)	(0.043)
Leverage	-1.228***	-1.212***	-1.256***
	(0.300)	(0.299)	(0.297)
Growth	0.0213	0.023	0.024
	(0.046)	(0.046)	(0.046)
Listexg	0.226*	0.232*	0.235*
	(0.133)	(0.133)	(0.134)
Constant	4.127***	3.966***	4.081***
	(0.555)	(0.557)	(0.552)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	942	942	942
Adjusted R-squared	0.460	0.459	0.464
Cluster	Firm	Firm	Firm

The table reports the OLS result of the relation between excess board seats control and firm value of listed CEs, absorbing the fixed effect of industry and year.

Excess_board_seats_control is measured by three alternative methods. In Column (1), it is calculated by the proportion of affiliated directors divided by cash-flow rights owned by the central government. In Column (2), it is calculated by the affiliated director ratio minus cash-flow rights. In Column (3), it is an indicator variable that equals 1 if the proportion of affiliated directors exceeds the cash-flow rights, otherwise equals 0.

For a description of the other variables, please refer to Table 3-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 3-13 The effect of external mechanisms on excess board seats control and firm value

Panel A: The effect of the external auditor on the relation between excess board seats control and firm value

	Big 4=0			Big 4=1		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Excess_board_seats_control_ratio	-0.148***			0.263***		
	(0.045)			(0.080)		
Excess_board_seats_control_difference		-0.467**			0.712**	
		(0.233)			(0.327)	
Excess_board_seats_control_dummy			-0.283**			0.182
			(0.117)			(0.162)
Control variables	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	777	777	777	165	165	165
Adjusted R-squared	0.466	0.462	0.468	0.558	0.506	0.486
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Panel B: The effect of the foreign investor on the relation between excess board seats control and firm value

	Foreign_investor=0			Foreign_investor=1		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Excess_board_seats_control_ratio	-0.131***			0.016		
	(0.047)			(0.113)		
Excess_board_seats_control_difference		-0.463**			0.015	
		(0.222)			(0.359)	
Excess_board_seats_control_dummy			-0.297***			0.076
			(0.113)			(0.142)
Control variables	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	804	804	804	137	137	137
Adjusted R-squared	0.467	0.465	0.471	0.446	0.445	0.447
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Panel A reports the OLS results of the relation between excess board seats control and firm value in groups with and without the big 4 accounting firms. *Big 4* is an indicator variable that equals 1, if the listed CEs hire the big 4 as their external auditor, and 0, otherwise.

Panel B the reports OLS results of the relation between excess board seats control and firm value in groups with and without foreign institutional shareholdings. *Foreign_investor* is an indicator variable that equals 1, if the listed CEs have foreign institutional investors and 0, otherwise.

Excess_board_seats_control is measured by three alternative methods (the ratio of affiliated director ratio and cash-flow rights owned by the central government, the difference between the affiliated director ratio and cash-flow rights, and dummy variable).

For a description of the other variables, please refer to Table 3-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Chapter 4 (Study 2) Independent Directors and Investment Efficiency

4.1 Introduction

The independent director is widely considered as being an effective corporate governance mechanism that improves firm performance and shareholder value in many countries. In China, many scholars (e.g. Lo et al., 2010; Liu et al., 2015; Zhu et al., 2016) have provided decisive evidence of the functions of independent directors on firm performance in publicly listed corporations, since the Chinese government set up a legal independent director system in 2001. CSRC regulates that the independent directors should protect the wealth of minority shareholders by monitoring operation activities and providing professional and valuable suggestions about the firm's strategy decision-making (CSRC, August,2001, Article 1.2). Investments are important economic activities that contribute to firm performance, which requires monitoring and professional advice from independent directors. The investment activity is profit oriented and is affected by other aspects, such as agency problems and information asymmetry (Stein, 2003)[29]. These factors may bring adverse effects to investment activities, which leads to inefficiency of firm investment. Based on the functions regulated by the government, the independent directors should have positive effects that mitigate the investment inefficiency of listed firms, such that they can improve firm value accordingly.

However, only a few studies (e.g. Chen and Xie, 2011; Ke et al., 2012; Zheng et al., 2013) have investigated the relationship between independent directors and investment efficiency in the Chinese stock market. If the independent director system in China does not work as expected, then what is the appropriate reform direction for this governance mechanism? And if it does work, does it fit all types of Chinese firms? Hence, this study is about

[29] See Stein (2003) for a comprehensive review. Agency conflicts occur between the managers and outside shareholders in a dispersed ownership structure, and between majority and minority shareholders in a concentrated ownership structure. One party (i.e., managers or majority shareholders) may expropriate the interests of another party (i.e., outside shareholders or minority shareholders) to achieve its private benefits. Information asymmetry provides an environment for the party with more or better information to fulfil the expropriation of the wealth of the other party.

investigating the relationship between independent directors and investment efficiency among listed CEs in China.

As one of the largest emerging markets, China is attracting more attention from the world. In China, the state shares still dominate the stock market even following with the state-owned enterprise (SOE) reforms that were initiated in 1978. Some researchers (e.g. Chen et al., 2011b; Ke et al., 2012; Liu et al., 2014) distinguish SOEs and non-SOEs in their studies, but very few breakdown SOEs into delineated categories. The listed CEs are a unique form of SOE, whereby they are ultimately controlled by the central enterprises that are solely owned by the State-owned Assets Supervision and Administration Commission (SASAC)[30]. SASAC is an institution under the management of the central government in China. Unlike listed local SOEs (ultimately owned by the local governments) that are distributed across multiple industries, the listed CEs are concentrated in several focused industries. Following the SOE reform, the majority of listed CEs are in the utilities, military and natural resource sectors.

Moreover, these state sectors are generally monopolies and policy favouring, which makes it hard for private firms, even local SOEs, to participate in. Such a close connection with the central government makes the investment efficiency of listed CEs deviate from the optimal level (Chen and Chi, 2015)[31]. For instance, the strong political background provides the listed CEs easier access to external finance resources (e.g. bank loans), which is likely to result in excess investments. Alternatively, the listed CEs may take on poor investment projects to help the central government accomplish its social and political goals. Overall, the investment decisions made by listed CEs must consider the political complexion, which is not totally driven by maximizing firm value.

[30] The central enterprises solely owned by SASAC are the ultimate controller of listed CEs, and therefore, SASAC is the ultimate owner of listed CEs. This is because the central enterprises represent SASAC to exercise the control and management on listed CEs, as SASAC is an official institution of the central government that could not participate in operating management and strategies decision-makings of every listed CEs.

[31] Chen and Chi (2015) examine the investment efficiency of listed CEs located in manufacturing sector, finding that over-investment is common in them, and suggest a state-owned capital operating budget system can mitigate over-investment activities of listed CEs.

Here, this study hypothesises that the independent director is an effective corporate governance mechanism that can help the listed CEs improve investment efficiency. Moreover, following the literature of Byrd and Hickman (1992) and Block (1999), who suggest the relationship between independent directors and firm performance is non-linear, this study hypothesises that the relationship between independent directors and investment efficiency is curvilinear as well. In order to examine this non-linear relationship, the main regression model involves the quadratic term of the proportion of independent directors. Additionally, if the independent directors have an impact on the investment efficiency of listed CEs, how do they work with different kinds of investment inefficiency (over- or under-investment)? Hence, there is also an examination of the relationship between independent directors and firm investment efficiency in two subsamples (over- and under-investment groups). In order to investigate whether other aspects of independent directors, such as the performance and characteristics, affect the investment efficiency of listed CEs as well, this study conducts related additional tests. Last, this study investigates the effect of the extra control from the ultimate owner (i.e. the central enterprises on behalf of the central government) on the relationship between independent directors and investment efficiency.

The sample of this study includes 979 firm-year observations comprising 229 unique listed non-financial A-share CEs in the period from 2012 to 2016. As the calculation of investment efficiency needs one-year lagged information, these listed firms should be ultimately owned by the central government in two consecutive years. Such information was checked manually through the annual reports. Other governance and finance related information was obtained from the Chinese Securities Market and Accounting Research (CSMAR). This study delivers the following main findings.

First, the relationship between independent directors and investment efficiency is a U-shaped curve after controlling for other factors that may affect investment efficiency. The turning point of the independent director ratio is 0.473, suggesting that before this point, their proportion has a negative effect on investment efficiency. When the proportion exceeds the critical mass (the proportion of independent directors on the corporate board is

47.3%), the independent directors start to play a positive role in improving investment efficiency. Moreover, the empirical results are robust with several sensitivity tests (e.g. alternative investment variables and alternative regression models). Furthermore, one-year lagged independent variables and IV-GMM (instrument variables - generalised method of moments) are employed to address the potential endogeneity issue. The result of the PSM (propensity score matching) method shows that the U-shaped relation between independent directors and investment efficiency is a unique phenomenon in listed CEs, as there is no significant evidence in matched listed non-CEs that have similar firm and board characteristics as listed CEs.

Second, there exists the U-shaped relationship between independent directors and investment efficiency in the over-investment group, but not in the under-investment group. This implies that independent directors are playing a more significant role in reducing excess investments. Overall, the independent directors have a positive effect on improving investment efficiency in listed CEs, when their proportion exceeds a certain level, especially for over-investment firms.

Third, this study explores how the performance of independent directors affects the investment efficiency of listed CEs, in particular, regarding the frequency of independent directors delegating a representative to attend board meetings. As over half of the listed CEs do not have this phenomenon, the OLS estimation may lead to estimation bias. Hence, this study deploys the Heckman selection model, and the results show that a high frequency of independent directors delegating a representative to attend board meetings weakens investment efficiency in the full sample as well as for the over- and under-investment groups.

Fourth, in the full sample and the over-investment group, the listed CEs with significant gender diversity (more women in the independent director team) have better investment efficiency, whereby the female independent directors are less likely to be overconfident and play a better role in monitoring. Meanwhile, in the over-investment group, the listed CEs with significant age diversity of the independent director team (i.e. the standard deviation

of independent director's age scaled by the average age of independent directors on the corporate board) have better investment efficiency as well.

Last, the listed CEs are divided into two groups based on whether they have extra control from the ultimate owner (i.e. the central enterprises on behalf of the central government) and examined with the main regression model. This is to find out whether extra control affects the relationship between independent directors and investment efficiency. Extra control in this study refers to whether the separation of control and ownership owned by the central government (i.e. the ratio of the voting rights to cash-flow rights) is over one. If yes, then this listed CE is classified in the group with extra control from the central enterprises and if no, then this listed CE is in the group without it. The influence of extra control is significant, as there is no significant relationship between independent directors and investment efficiency in the group with extra control from central enterprises. This means extra control from the central enterprises blocks the function of independent directors no matter how many are on the corporate board. In the group without extra control from central enterprises, a consistent result emerges with the main regression, i.e. there is a U-shaped relationship between independent directors and investment efficiency. When this study extends the test to the over-and under-investment groups, a similar result is found in the over-investment group. It implies that this extra control hinders the function of independent directors from reducing excess investments. However, there is no significant effect of extra control on the relationship between independent directors and investment efficiency in the under-investment group.

The outcomes of this study lead to theoretical and empirical contributions to the literature, in particular, they enrich the existing literature on independent directors. In the literature, agency theory (Jensen and Meckling, 1976) is employed to explain the potential positive function of independent directors, and stewardship theory (Davis et al., 1997) is drawn upon to explain the potential negative function of these directors. However, this study documents that the relationship between independent directors and investment efficiency in listed CEs is not monotonously positive or negative, and it also depends on the proportion of independent directors on the corporate board. Inspired by the critical mass theory (Kanter,

1977), which is widely applied in analysing how women work in organisations, this study finds that before reaching the critical mass point, the proportion of independent directors has a negative effect on investment efficiency, which is also supported by stewardship theory. Also, when the proportion of independent directors exceeds the critical mass point, independent directors start to play a positive role in improving investment efficiency, which is in line with agency theory. This study also provides evidence for the literature on the investment that the independent director system can be an efficient mechanism for mitigating investment inefficiency issues, when there are enough independent directors on the corporate board. Second, this study provides empirical evidence that the relation between independent directors and investment efficiency is a U-shape, instead of the simple linear relationship shown in past studies. Moreover, only listed CEs have this kind of relationship, which, as explained previously, are a special kind of listed firms with a strong connection with the central government. Scant previous literature has focused on listed CEs. Hence, this study investigates the relationship between independent directors and investment efficiency in a complicated firm environment.

The rest of this study proceeds as follows. Section 4.2 introduces the related literature and develops the hypothesis. Section 4.3 provides the details of research methodology and data. Section 4.4 reports the main empirical findings and sensitivity tests. Section 4.5 presents the empirical results of extended tests. Section 4.6 discusses this study.

4.2 Literature review and hypothesis development

Whether the independent director is an effective corporate governance mechanism is widely discussed, but there is no conclusive result. Bhagat and Black (1999) review previous studies and document that there is no empirical support for more independent directors on the corporate board improving firm performance. They highlight that a listed firm in the U.S. usually has a majority of independent directors on the board. This "supermajority independent board" does not enhance firm value as the participation by insiders is scarce. In contrast, most of Chinese listed firms have an insider-dominant board. Liu et al. (2015) make a comparison of independent directors between the U.S. and China for the period from 1999 to 2012 and report that the average fraction of independent directors on the corporate board in the U.S. is 71%, while that in China is 30%. So, in China, under an insider-dominant environment, the question is whether adding more independent directors to the corporate board works well? The answer from Clarke (2006) is no, as he fails to find significant and positive evidence about the effect of independent directors on corporate performance in past empirical studies. For instance, Tian and Lau (2001) find no positive relationship between the independent director ratio and corporate performance, using 113 firms listed in 1996. Gao and Ma (2002) use firms listed on the Shanghai and Shenzhen stock exchanges in 2001 and compare the listed firms that appointed independent directors in the past three years with those that did not. They document that there is no significant difference in performance between these two kinds of firms, i.e. the independent directors have no impact on corporate performance. One potential reason that such directors do not seem to work well is the absence of a legal independent director system in China. That is, all the empirical evidence reviewed by Clarke was around 2001 or before, at a time when the independent director mechanism was still in its preliminary stages.

Since CSRC announced the *Guidance Opinion on the Establishment of an Independent Director System in Listed Companies* in August 2001 and regulates that listed firms must have at least one-third independent directors on the corporate board before July 2003, more literature has provided strong empirical evidence of the positive function of independent directors in China. For instance, Lo et al. (2010) observe that listed firms with a

higher proportion of independent directors are less likely to engage in transfer pricing manipulations in related-party sales transactions. Liu et al. (2015) report independent directors have an overall positive role in improving firm operating performance and perform better in government-controlled firms. Wang et al. (2016) conducted a further study to examine the effect of the backgrounds of independent directors on corporate performance in SOEs. They find that the diversification of independent directors can improve the corporate performance of SOEs. Zhu et al. (2016) manually collected the independent-director rankings[32] from the annual reports. They document that the independent directors with a higher ranking are more powerful at improving firm value. Hu et al. (2017) examine the monitoring power of independent directors by building up an index[33] and find that the combined independent director monitoring power index is positively related to the internal control quality. It confirms the effective monitoring function of independent directors. Cullinan et al. (2017) investigate the effect of independent directors on tunnelling activities, considering the power of shareholders. They find that independent directors are more effective at reducing tunnelling when relatively minority shareholder power is higher. Shan (2019) reports that the proportion of independent directors has a positive relationship with the extent of voluntary related-party transactions disclosure.

In China, the independent director is playing an increasingly efficient role in corporate governance (Chen and Xie, 2011; Ke et al., 2012; Zheng et al., 2013). Under agency theory, Fama and Jensen (1983) suggest that independent directors have the function of monitoring management behaviours and reducing agency costs. In Chinese regulations, CSRC regulates that the primary duty of independent directors is to protect the overall interest of the company and has set up the guidance on how to mitigate any agency conflicts among the stakeholders. Investment decision-making is one of the most likely potential reasons leading to such agency conflict. In firms with dispersed ownership, managers may waste the wealth

[32] Zhu et al. (2016) find that in China, directors on the corporate board are listed in annual reports in a meaningful order. Such a board hierarchy reflects the power of each director on the board and the empowered directors can set the tone of the discussion. They mark the first listed director with highest value that equals the number of total directors on the board, and the value of the second listed director equals the board size minus 1. The value of the third director equals the board size minus 2, and so on. Based on the sequential order, the last listed director is marked as 1. Then they standardise the ranks by dividing by the board size.

[33] The combined independent director monitoring power consists of specialist expertise or competence, incentives, balancing power and diligence.

of shareholders and invest in relatively higher risk projects to fulfil personal benefits, if these projects provide higher ones to the management team (Jensen and Meckling, 1976; Jensen, 1986; Stein, 2003). In addition, in firms with concentrated ownership, the controlling shareholder may expropriate the wealth of minority shareholders by intervening in investment decision-making (Pindado and de la Torre, 2009; Chen et al., 2014b).

Besides the monitoring role of independent director, CSRC regulates the advisory role of independent directors as well. These directors in listed firms are experts from various fields, such as industry, academia, and retired government bureaucrats. Their professional advice is valuable, in particular, for choosing the most appropriate investment strategies and investment decision-making. Hence, the effect of the independent director mechanism on investment efficiency is crucial. However, in China, the literature examining whether the function of independent directors in improving the investment efficiency of firms is limited. Chen and Xie (2011) employ the social network method to measure the location of independent directors in the network of directors on the board. They find that those directors with higher network centrality[34] improve the efficiency of firm investments. Ke et al. (2012) document the positive effect of independent directors on investment efficiency with evidence from China's non-financial A-share listed firms. The proportion of independent directors is positively related to investment efficiency, while their compensation does not have a significant effect. Zheng et al. (2013) examine the impact of the characteristics of independent directors on investment efficiency. They find that firms with more independent directors that are female, elders or that have an accounting related background have better investment efficiency. Liu et al. (2015) also confirm the critical role of independent directors in promoting the investment efficiency of listed firms by examining a sample of Chinese listed firms in a period from 1999 to 2012.

Investment activities in a perfect world, as described by Modigliani and Miller (1958), are solely driven by a function of the investment opportunities set. However, in the real world, they are also affected by market friction, such as information asymmetry and agency problems (Stein, 2003). Moreover, the nature of listed firms' ultimate owner or controlling

[34] See Freeman (1978) for a detailed overview of network centrality. The concept of centrality refers to the locations of position or points in the network.

shareholders is regarded as friction affecting investment decision-making as well. For instance, the investment decision-making in SOEs may suffer the influence of governmental authorities. Chen et al. (2017) report that state ownership weakens investment efficiency with world-wide evidence covering 64 countries. Regarding studies in China, Chen et al. (2011b) examine the effect of state ownership on investment efficiency. They find that the investment efficiency of non-SOEs is better than that of SOEs and the political connected top executive is negatively related to investment efficiency in the state sector. Ding et al. (2016) document that corporate investment is more efficient in non-SOEs, according to a comprehensive dataset of more than 100,000 Chinese firms over the period 2000 to 2007.

As the literature shows, SOEs have more severe investment efficiency problems compared with non-SOEs and whether independent directors can help the former mitigate investment inefficiency caused by significant government intervention is worth investigating. Ke et al. (2012) study the relationship between independent directors and investment efficiency with evidence from China and consider the potential effect from the nature of property rights. They divide Chinese listed firms into SOEs and non-SOEs and find that the positive effect of independent directors on investment efficiency in the former is less significant than in the latter. They argue that this is probably because, the executives in SOEs prefer to recommend and select independent directors who are beneficial to their political promotions instead of having a real impact on the listed firm.

However, the evidence in listed SOEs that are ultimately controlled by the local governments and the central government may not be consistent, because of the different political purposes and strategies of these two kinds of authorities (Chen et al., 2009). Hence, for this study, the focus is on examining the effect of independent directors on investment efficiency among listed CEs. As most of the recent related literature states that there is a direct positive linear relationship between independent directors and investment efficiency based on agency theory, here it is proposed that:

H1: There is a positive relationship between independent directors and investment efficiency in listed CEs.

However, a simple linear relationship may not explain the whole story and hence, this study also involves examining whether the relationship between independent directors and investment efficiency is curvilinear. As mentioned before, most Chinese firms have an insider-dominant board, and not enough of independent directors on the caproate board may result in the insignificant effects of their monitoring power. Correspondingly, when there are sufficient independent directors on the corporate board, the monitoring mechanism from independent directors may start to play a positive role, which is as agency theory suggests. This is also supported by critical mass theory, under which it is held that the group interactions will change, once minority representation has reached a critical mass point (Kanter, 1977; Collins et al., 2010). In other words, when there are enough members in a group, it will become influential in the organisation.

Whilst most listed firms follow the *Guidance Opinion* from CSRC and maintain at least one-third of directors on the corporate board as independent, these directors are still the minority group. So, the independent director group has difficulties suppressing the voice from executive directors and affiliated directors representing the interest of the controlling shareholders. Also, these one-third independent directors may not have enough motivation and power to fulfil their regulated responsibilities, because the purpose of listed firms having just one-third independent directors on the corporate board is most likely to cater the related regulations and the power that they have acquired through the legislation is generally just nominal (Wu et al., 2007). In this case, when listed firms decide to add more independent directors on the existing basis, but do not reach the critical mass, their effect may not be positive, and it may even be detrimental. This is because, if adding independent directors could not change the minority status of this group, it could lead to more agency costs for shareholders. Moreover, Tian and Lau (2001) suggest a negative relation, according to stewardship theory proposed by Davis et al. (1997). Under this perspective, they argue that the manager in the firm works as a steward, who seeks to maximise the wealth of shareholders, instead of diverting the firm's resources due to personal benefits. Also, it is assumed that the recognition from the organisations is essential for top executives, such that they are trusted and hence, granted decision-making power, i.e. being motivated to enhance their performance. Therefore, adding extra independent directors may result in resistance from the management. Moreover, the lack of cooperation and trust between the

corporate board and the management will lead to passive corporate performance, especially when independent directors do not have strong power on the corporate board. For listed CEs, most existing directors and executives have a political background, thus maybe being more opinionated and unwilling to be challenged by the outsiders. Under this situation, adding more independent directors to the current mandatory one-third basis, but not reaching the critical mass, then the potential adverse reaction from the existing directors and executives may be more significant. This could, consequently, lead to worse investment efficiency among listed CEs.

Accordingly, this study hypothesises that there is a non-linear relation between independent directors and investment efficiency in listed CEs. That is, before reaching the critical mass point, the independent directors have a negative relationship with investment efficiency and after the proportion of independent directors exceeds the critical mass point, they start to have a positive effect on this efficiency. The second hypothesis is specified as:

H2: the effect of independent directors on investment efficiency has a U-shaped relationship in listed CEs.

4.3 Research design and data

4.3.1 Methodology and variables

(1) Investment efficiency

This study utilises the extended cash flow investment model following Richardson (2006), Chen et al. (2011b), Shen et al. (2015) and Chen et al. (2016), among others. The regression used to estimate investment efficiency is specified in Equation (4.1):

$$INV_{i,t} = \beta_0 + \beta_1 Investment\ opportunities_{i,t-1} + \beta_2 Leverage_{i.t-1} + \beta_3 CF_{i,t-1} + \beta_4 Firmage_{i.t-1} + \beta_5 Firmsize_{i,t-1} + \beta_6 Return_{i,t-1} + \beta_7 INV_{i,t-1} + fixed\ effects\ of\ Industry\ and\ Year + \varepsilon_{i,t} \quad (4.1)$$

where the dependent variable (*INV*) is the investment expenditure in the year, which is measured by the difference between the cash payments for fixed assets, intangible assets, and other long-term assets, and the cash receipts from selling those assets, scaled by the beginning total assets (Chen et al., 2011b). The independent variable, *Investment opportunities*, is represented by Tobin's Q, which is commonly used in related studies (Opler et al., 1999; Richardson, 2006; Wan et al., 2015; Xie, 2015; Chen et al., 2017). In this study, Tobin's Q is calculated from the market value of equity and net debt over total assets. *Leverage* is the proxy of the financing constraints of the firm, which is measured by total debt over total assets. *CF* is the net operating cash flow scaled by the beginning total assets and the information about the net cash flow is taken from the cash flow statement. *Firmage* is the number of years that the firm has been publicly listed on the stock market. *Firmsize* is the natural logarithm of total assets, whilst *Return* is the annual individual stock return with cash bonus and all these independent variables are one-year lagged. The one-year lagged investment expenditure is also added to the regression model. In addition, the fixed effects from industry and year are controlled for by adding industry and year dummy variables in the regression model. As the listed CEs are concentrated in certain industries, this study follows the *Guidance for Industry Classification of Listed Companies* (1999) released by the

CSRC and divides them into four industries: Utilities, Conglomerates, Industrials, and Commerce.

The error term ($\varepsilon_{i,t}$) in Equation (4.1) shows the difference between the actual and expected investment level of listed CEs, which is used to represent investment efficiency. A positive value of residuals means that the actual investment level of listed CEs is over the optimal one. In contrast, a negative value means that the actual investment level is under the expected one. This study uses the absolute value of residuals as the dependent variable (*Abs_INVEFF*) in the following regression, which can reflect the overall investment efficiency of listed CEs. So, the higher the absolute value of residual means the more severe the inefficient investment level in the company.

(2) The proportion of independent directors and investment efficiency

This study examines the relation between the proportion of independent directors and investment efficiency among listed CEs. As with the hypothesis developed previously, this relation might be curvilinear. The independent directors come to work efficiently when their proportion reaches a certain level. Hence, this study adds a quadratic term into the regression followed by several control variables[35]:

$$Abs\_INVEFF_{i,t} = \beta_0 + \beta_1 Independent\_directors_{i,t} + \beta_2 Ind\_square_{i,t} + \beta_3 Fees_{i,t} + \beta_4 Ceo\_duality_{i,t} + \beta_5 Boardsize_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 Firmsize_{i,t} + \beta_8 Firmage_{i,t} + \beta_9 Listexg_{i,t} + fixed\ effects\ of\ industry\ and\ year + \varepsilon_{i,t} \quad (4.2)$$

where *Independent_direrctors* is measured by the proportion of independent directors to the total number of directors on the corporate board. *Ind_square* is the quadratic term of the independent director ratio. As discussed before, if independent directors have a linear

[35] Chen et al. (2018) argue that applying the residuals derived from an OLS regression as the dependent variable in the second regression may lead to estimation bias of coefficients in the second-step regression and suggest using the single-stage regression that includes all the model regressors into a single regression. However, this method is not applicable here, as this study also tries to identify over- and under-investments. Hence, this study conducts the standard two-stage regression model rather than the single-stage regression advocated by Chen et al. (2018).

relationship with the investment efficiency of listed CEs, a negative coefficient of *Independent_direrctors* is expected, as the lower value of *Abs_INVEFF* represents higher investment efficiency. Correspondingly, if there is a U-shaped relation between independent directors and investment efficiency in listed CEs, a positive coefficient of *Independent_direrctors* is anticipated and a negative coefficient of its quadratic term (*Ind_square*). Following the previous literature (Ang et al., 2000; Bushman and Smith, 2001; Stein, 2003; Li and Wang, 2010; Ke et al., 2012), several other factors that may affect investment efficiency are included in the regression model as control variables.

Fees represents the management fees ratio, measured by the total management cost over annual income. The sign of *Fees* is expected to be negative, as Yanxi et al. (2015) find that listed firms with a higher management fees ratio have better investment efficiency in China.

Ceo_duality is a dummy variable that equals one, if the chairman holds the position of CEO at the same time and 0, otherwise. Terjesen et al. (2015) suggest that, if the CEO and chairman are the same person, she/he has higher power and may interfere with the monitoring function of independent directors. On the other hand, Donaldson and Davis (1991) argue that the chairman of the corporate board holding the position of CEO at the same time can improve the efficiency of decision-making.

Boardsize is the number of directors on the corporate board. Some literature, such as Guest (2009) with evidence from the UK, Mak and Kusnadi (2005) with evidence from Singapore and Malaysia and Conyon and Peck (1998) with evidence from European countries, suggests a negative relation between board size and firm performance. This supports the argument that poor communication and decision-making reduce the effectiveness of a large board. Hence, the effect of board size on investment efficiency may be negative.

Leverage, Firmage and *Firmsize* are defined the same as those variables in Equation (4.1). Ke et al. (2012) find that an appropriate increase in debt improves investment efficiency, which is consistent with the free cash flow hypothesis raised by Jensen (1986). Large and mature firms may have more experience in management and hence, are more likely to keep their

investment around an optimal level. *Listexg* is used to identify the stock exchange which these listed CEs come under. It equals one, if a listed CE is on the Shanghai Stock Exchange and zero, if on the Shenzhen Stock Exchange. Equation (4.2) controls for the fixed effects of industry and year as well. The specific definitions of main variables in Equation (4.2) are summarised in Table 4-1.

4.3.2 Data and sample selection

This study collected related information of all listed CEs over the main research period from 2012 to 2016, to examine the relation between the independent director mechanism and investment efficiency among listed CEs. This study also collected the data in 2011, as the estimation of investment efficiency needs one-year lagged information. The number of listed CEs changes in years, which is because the nature of the firm may change according to the change of its ultimate owner. To ensure that all observations during the research period were owned by the central government, the ultimate owner of observations was checked manually from annual reports. The financial and corporate governance related information was obtained from the Chinese Securities Market and Accounting Research (CSMAR) Database. This study dropped the listed CEs in finance and real estate industries, as well as observations with negative equity. The listed CEs that go public in the current year have been excluded, as CSMAR does not provide pre-IPO related financial information and investment efficiency calculation needs one-year lagged data. Also, Chen et al. (2011b) suggest that it can avoid the potential influence of large investments following IPOs. Finally, after calculating the dependent variable and dropping the missing values of main variables employed in the main regression, this study obtained a sample of 979 firm-year observations by 229 unique listed CEs.

Panel A of Table 4-2 reports the regression results of the investment model. The sign of the coefficient of each independent variable is consistent with that in past studies (e.g. Richardson, 2006; Ke et al., 2012; Chen et al., 2016). The leverage ratio and age of listed CEs are negatively related to the investment expenditure, and the rest factors have a positive relationship with it. All independent variables are jointly significant at the level of 1%, as the

F-value of this regression model is 24.82. The R^2 is 0.353, showing this regression model has good explanatory power. This study also calculates the mean VIF of this model, as it is the indicator of the multicollinearity problem. The value of that is 1.68, indicating that there is no related problem in this regression model. Then, the absolute value of the residuals of this reliable regression model is employed as the dependent variable (*Abs_INVEFF*) in the main regression.

Panel B of Table 4-2 presents the distribution of over- and under-investment firms in years. During this 5-year research period from 2012 to 2016, 38.4% listed CEs have excess investment issues and the investment of 61.6% listed CEs is lower than the optimal investment size. This intuitive result is consistent with Chen et al. (2011a), who use a worldwide sample of private firms and Chen and Xie (2011), with a sample of Chinese listed firms, finding that under-investment is a more prevalent issue in capital markets. The proportion of over-investment firms floats in a small range of around 38%. The highest proportion of over-investment firms was 40.6% in 2015 and the lowest at 34.8%, in 2016. Overall, the total number of listed CEs decreased in this research period, because of the privatisation of small SOEs and corporatisation of larger ones, which has been a crucial part of the SOE reform promoted by the Chinese government in the last twenty years (Cao et al., 1999; Lin and Zhu, 2001; Wang et al., 2004).

Panel C of Table 4-2 displays the descriptive statistics for the measures of investment efficiency, independent directors and the main control variables used in the analysis. Whilst over-investment firms do not occupy the majority of the listed CEs, the investment inefficiency (*Over_INVEFF*) among them is severer than that in the under-investment group. Specifically, the actual investment level in the over-investment group is, on average, 0.0313 over the optimal investment level, while that in the under-investment group (*Under_INVEFF*) is, on average, 0.0195 below this level. The average proportion of independent directors on the corporate board is 37.1%, which is similar to the policy regulated by CSRC that at least one-third board members on the corporate board should be independent. However, some listed CEs do not meet this requirement, with the minimum proportion of independent directors on the board being 23.1%. On average, the listed CEs have ten members on the

corporate board and the majority of them has a different person in the role of the chairman and CEO. For the financial related control variables, the average listed CE has 7.7% of total revenue used to cover the management fees and a leverage ratio of 53%, measured by total debt over total assets. The average listing years of listed CEs is 14. The age of the youngest listed CE is two years, as one-year lagged information is required to calculate the dependent variable, whilst the oldest listed CE has been in the capital market for 24 years. The firm size varies from 0.31 to 2405.38 billion RMB and *Listexg* shows that around 70% of the listed CEs are with the Shanghai Stock Exchange.

Table 4-3 provides Pearson correlations among the independent variable and control variables employed, which is an intuitive check for multicollinearity. In Table 4-3, the correlation coefficients among all the main variables do not have an absolute value higher than 0.7, which could indicate that the multicollinearity problem is a significant issue. Hence, there is no considerable multicollinearity interference that may affect the main regression.

4.4 Empirical results

4.4.1 The impact of independent directors on investment efficiency

Table 4-4 shows the regression results testing the hypotheses developed before. Column (1) reports those of the model involving the independent director ratio to examine the potential linear relationship between independent directors and overall investment efficiency. The coefficient of *Independent_directors* in Column (1) does not provide significant evidence that independent directors have a linear relationship with the overall investment efficiency of listed CEs.

Next, the potential non-linear relationship between independent directors and investment efficiency is examined, by adding the quadratic term of the independent director ratio into the main regression model, with the empirical results being shown in Column (2). The model including the quadric term of the independent director ratio provides a higher R^2, which shows better power for explaining the relation between independent directors and investment efficiency. The positive coefficient of *Independent_directors* in Column (2) is significant at the 5% level and the coefficient of *Ind_square* is significant at the 1% level, which indicates a curvilinear relationship between independent directors and investment efficiency. Specifically, the relation between the proportion of independent directors and investment efficiency is a U-shape, as the lower value of *Abs_INVEFF* means higher investment efficiency. In other words, the independent directors begin to play a positive role when their proportion on the corporate board exceeds the critical mass point. The turning point (critical mass) of the proportion of independent directors in Column (2) is 0.473 (0.292/ (-(-0.309) ×2)). It suggests that if the listed CEs have met the rule of independent directors, as regulated by the Chinese government and then, add more such directors to the corporate board, this will improve the investment efficiency of the firm. However, this action could also lead to a negative effect on investment efficiency, if the adjusted proportion of independent directors on the corporate board does not exceed 47.3%.

For the control variables[36], the coefficient of *Ceo_duality* in Column (2) is significantly negatively related to overall investment efficiency, which means the chairman of the corporate board taking the position of CEO at the same time can improve the investment efficiency of listed CEs. This supports the result documented by Donaldson and Davis (1991) that CEO duality leads to better and faster decisions, which then improves firm performance. The negative coefficient of *Firmsize* is significant at the 10% level, which means that the large listed CEs face fewer investment inefficiency issues than the small ones. *Firmage* in the main regression model provides significant evidence that mature firms perform better in controlling firm investments at an optimal level than do young firms, as indicated by the coefficient of *Firmage* being negative and significant at the level of 10%. This may be because the mature firms have more management experience. Chen et al. (2011b) contend that firms with longer listing years are more likely to be in the mature or declining stage of the business cycle, which leads to reduced investment activities. This elicits the potential alternative explanation that it is easier for mature firms to avoid excess investments, as they are not eager to expand the business compared with young firms that are in the growth stage.

4.4.2 Sensitivity tests

This subsection conducts three sensitivity tests related to the main regression. All listed CEs are perceived as having investment inefficiency problem, since all the regression residuals in Equation (4.1) are different from zero. However, the residual value of some listed CEs is very close to 0 (i.e. the maximum value of the negative residuals is -0.00000618). It means that, in fact, the difference between actual and expected investment is negligible. In other words, such a kind of listed CEs can be regarded as those without significant investment inefficiency problems. Following Biddle et al. (2009) and Chen et al. (2011a), this study sorts the observations into deciles for positive and negative residual groups separately. Next, this study drops the observations belonging to the decile that is closest to 0 (in both positive and negative residual groups), as these can be perceived as investment efficient firms. Then, the

[36] As listed CEs suffer significant influence from the central enterprises, the potential effect of affiliated directors from the central enterprise or its affiliations on investment efficiency is controlled for. After doing so, a similar empirical result with that of the main regression in this study is obtained.

main regression with the remaining observations that are considered to have significant investment inefficiency problems is repeated.

Second, this study utilises another investment model to robustly check the relationship between the independent director ratio and overall investment efficiency. This is a function of growth opportunities measured by annual revenue growth rate (*RevGrowth*). A dummy variable (*NEG*) is added into the regression, as Chen et al. (2011a) and Cutillas Gomariz and Sánchez Ballesta (2014) suggest that a positive or negative increase in revenue may have different effects on investments. The following regression specification derives the alternative optimal investment estimation:

$$INV_{i,t} = \beta_0 + \beta_1 NEG_{i,t-1} + \beta_2 RevGrowth_{i.t-1} + \beta_3 NEG * RevGrowth_{i,t-1} + \varepsilon_{i,t} \quad (4.3)$$

where the investment expenditure spent in year i (*INV*) follows the same definition used in Equation (4.1). All independent variables take a one-year lagged term. The indicator dummy variable *(NEG*) equals 1 when the revenue growth is negative and 0, otherwise. Following Chen et al. (2011a), the alternative investment efficiency model is estimated cross-sectionally with at least five observations in each industry by year. The absolute value of residuals derived from Equation (4.3) is the new investment efficiency. Then the main regression with new investment efficiency is repeated.

Third, the piecewise linear regression is applied to detect the presence or not of a curvilinear relation between independent directors and investment efficiency. Follow Byrd and Hickman (1992), this study separates the proportion of independent directors into two piecewise variables based on the turning point (0.473) in the main regression. *Independent_directors (under 0.473)* equals the fraction of independent directors if it is under 0.473, and otherwise, it is 0.473*. Independent_directors (above 0.473)* equals 0 if it is under 0.473 and equals the fraction of independent directors minus 0.473 if it is over this figure. The segmented regression can prove the non-linear relation between independent directors and investment efficiency if *Independent_directors (under 0.473)* provides a

significant positive coefficient and *Independent_directors (above 0.473)* delivers a significant negative one.

Columns (1) to (3) of Table 4-5 tabulate the results of these three robust tests. The first two columns provide consistent regression results with those obtained by the main regression specification. No matter the change of alternative estimation or the investment efficiency model, the U-shaped relation between independent directors and investment efficiency is significant at least at the 10% level. In Column (3), as expected, the coefficient of *Independent_directors (under 0.473)* is positive and significant at the 5% level, indicating a negative effect of adding more independent directors to the corporate board, but only if the new proportion of these directors does not exceed the critical mass point (0.473). While the significant negative coefficient of *Independent_directors (above 0.473)* provides evidence that the independent directors become valid on improving the overall investment efficiency of listed CEs when they represent more than 47.3% of the corporate board.

4.4.3 Potential endogeneity

There may be endogeneity problems between independent directors and investment efficiency, as the firm's investment efficiency can affect both the incentive of someone joining the board as an independent director and the motivation of adding more such directors to the corporate board. In order to address such a potential endogeneity problem due to causality, first the contemporary independent variables are replaced with one-year lagged ones. This is because the function of independent directors needs time to reflect on investment efficiency. Column (1) of Table 4-6 shows the empirical result with the one-year lagged independent director ratio and the quadratic term of the lagged independent director ratio. The results provide a consistent conclusion with that of the main regression. That is, the evidence shows that the independent director ratio has a quadratic relation with overall investment efficiency.

The alternative method is employing the instrument variables (IVs). The appropriate IVs must be exogenous and satisfy the conditions of instrument exogeneity and instrument relevance (Liu et al., 2014). Tan et al. (2007) and Liao et al. (2009) document that around 40% of independent directors in China are academics from the universities and most of them own the title of professor. Hence, the number of high education institutions (HEIs) in the same province with listed CEs and the number of employees in these HEIs with a senior professional title[37] can affect the proportion of independent directors on the corporate board. That is, if a province has richer human resources, the listed CEs in that province will find it much easier to identify a qualified person to be the independent director on their corporate board. In addition, CSRC regulates that one of the independent directors must have an accounting background, so the number of accounting firms in the province where the listed CEs are will affect the proportion of such directors on the corporate board. Whilst these three factors have a close relation with independent directors on the corporate board, they do not have direct effects on the investment efficiency of any specific listed CE. Furthermore, HEIs may have a non-linear relationship with the independent director ratio of listed CEs. The quadratic term *HEIs* is put into the first stage estimation as well. Hence, these

[37] There is a profession rank evaluation system in China. Professor is the title of a senior professional rank in HEIs.

four factors are utilised as instruments to estimate the independent variables in the main regression specification. *HEIs* is the number of HEIs in the same province as listed CEs, measured by the natural log of the number of HEIs in that province, whilst *HEIs_square* is the quadratic term of *HEIs*. *Senior* is an indicator variable that equals 1 if the number of people in the HEIs having a senior professional title in that province is above the national level, and 0, otherwise.[38] *Account* is an indicator variable as well, which equals 1, if the province has more than three branches of the big-12 accounting firms[39] and 0, otherwise. As with the main regression model, the standard errors are clustered by firm in each step of the estimations, which deals with both the heteroscedasticity and intra-group correlation problems. In addition, the number of excluded IVs exceeds the number of endogenous variables (the number of independent variables in this case), which are said to be over identified by the order condition for identification. In such a case of overidentification, Baum et al. (2007) suggest that IV-GMM (generalised method of moments) cluster-robust estimates will be more efficient than 2SLS (two-stage least squares) estimates and hence, the former method is adopted.

Hansen's J instrument test is conducted to examine whether these IVs (*HEIs*, *HEIs_square, Senior,* and *Account*) meet the exogeneity requirement. The value of the χ^2 statistic is 0.075, which is insignificant at the 10% level. In this case, the null hypothesis that the IVs are not correlated with regression errors cannot be rejected. Then, this study examines the relevance of these IVs through weak-instrument-robust inference. The values of χ^2 in the Anderson-Rubin Wald and Stock-Wright LM tests are 8.84 and 16.80, respectively. The result of these two tests leads to the rejection of the null hypothesis that the coefficients of the excluded IVs are jointly equal to zero, at least at the significant level of 10%. This confirms the sufficient correlation of the excluded IVs with the independent variables in the main regression model. In Table 4-6, Column (2) contains the first stage regression results of *Independent_directors* and Column (3), those of *Ind_square*, whilst Column (4) reports the

[38] Data relating to *HEIs* and *Senior* is disclosed by the Ministry of Education of the People's Republic of China. As the province level data only started in 2013, the data for *HEIs* and *Senior* in 2012 is replaced with the relevant data for 2013.

[39] Big-12 accounting firms include the four worldwide largest accounting firms (Deloitte, EY, KPMG, and PwC) and the eight local largest accounting firms (Dahua, Daxin, Lixin, Tianjian, Tianzhiguoji, Ruihua, Xinyongzhonghe, and Zhitong). The number of branches of these big accounting firms was manually collected from the website of the Chinese Institute of Certified Public Accountants.

findings of the second stage of the GMM estimation. The positive coefficient of *Independent_directors* and the negative one of *Ind_square* are significant at the level of 5%. Overall, the IVs approach provides a consistent result with the finding in the main regression that the independent directors have a U-shaped relationship with overall investment efficiency in listed CEs.

4.4.4 The relation between independent directors and investment efficiency for listed CEs vs. listed non-CEs

Despite a U-shaped relationship between independent directors and investment efficiency among listed CEs having been elicited, whether the relation between these two factors is generalised among all Chinese listed firm remains uncertain. In order to avoid the potential effects from the special characteristics of listed non-CEs, this study conducts the PSM (propensity score matching) method. By so doing, it is possible to find out the listed non-CEs with similar firm characteristics to listed CEs and to identify whether the U-shaped relation between independent directors and investment efficiency is a unique phenomenon in listed CEs. The logit treatment model includes the independent director ratio and the control variables in the main regression specification, which ensures that the matched listed non-CEs have similar firm characteristics as listed CEs. The matching method is the simple nearest-neighbour matching with one neighbour, according to the estimated propensity score. Finally, all 979 listed CEs get a one-to-one matched listed non-CE.

Panel A of Table 4-7 shows the mean of the main variables in matched listed non-CE and CE groups, with the difference of the means in these two groups being examined by a T-test. There is no significant difference of basic firm characteristics between the matched listed non-CEs and CEs, but the difference in investment efficiency of these two kinds of listed firms is significant at the 1% level. This suggests that the listed non-CEs did not perform well on investment efficiency as the listed CEs did during the study period.

The main regressions are repeated in the matched listed non-CE group. This study finds a similar result for the listed CE group, whereby the proportion of independent directors does

not have a linear relationship with investment efficiency, as the coefficient of the independent director ratio is not significant at least at the level of 10%. Also, the empirical result displayed in Column (2), Panel B, shows that neither of coefficients of *Independent_directors* and *Ind_square* is significantly different from zero, which indicates that there is no significant quadratic relation between independent directors and investment efficiency in listed non-CEs that have similar firm characteristics as listed CEs. Overall, the independent directors do not affect investment efficiency among matched listed non-CEs.

Having made this comparison, this study concludes that the U-shaped relation between independent directors and investment efficiency is a unique phenomenon in listed CEs. Hence, listed CEs should have more than 47.3% independent directors on the corporate board to improve their investment efficiency.

4.5 Extended tests

As the main regression shows, the proportion of independent directors has a significant U-shaped relation with the overall investment efficiency of listed CEs. This section further investigates the relationship between independent directors and investment efficiency in over- and under-investment groups, separately. Then, this section conducts additional tests about other factors of independent directors that may influence investment efficiency. Last, this section examines the effect of extra control from the ultimate owner on the relationship between independent directors and investment efficiency.

4.5.1 The effect of independent directors on over- and under-investments

The investment inefficiency problem of firms can be further classified into two kinds of scenarios: excess and insufficient investment. Both bring adverse effects to the development of firms. As the reasons leading to over- or under-investment are different, Biddle et al. (2009), Chen and Xie (2011), Ke et al. (2012), and Cutillas Gomariz and Sánchez Ballesta (2014) investigate the investment efficiency by separating investment inefficiency into these two groups. Chen and Xie (2011) find the network centrality of independent directors is positively related to investment efficiency in both over- and under-investment groups. They report that the higher network centrality of independent directors, not only reduces excess investments, for it also mitigates insufficient investment. That is, this centrality can improve the overall investment efficiency of listed firms. Hence, in this study, the effect of independent directors on these two kinds of investment inefficiency in listed CEs is investigated. In accordance with the above discussion about the effect of independent directors on the overall investment efficiency, this study examines the potential linear and non-linear relationship for each group as well.

Table 4-8 displays the effect of independent directors on these two kinds of investment inefficiency. This study splits all listed CEs into over- or under-investment groups, according to their positive or negative residuals derived from the investment efficiency model (Equation (4.1)). *Over_INVEFF* is the dependent variable in the over-investment group,

showing the level of over-investment represented by the positive residuals from Equation (4.1), whilst *Under_Abs_INVEFF* is measured by the absolute value of negative residuals from the investment efficiency model, representing under-investment inefficiency. Columns (1) and (2) show the empirical results in the over-investment group. For listed CEs with over-investment issues, the proportion of independent directors has a U-shaped relation with investment efficiency, which is consistent with the finding in the main regression. This is indicated by the insignificant coefficient of *Independent_directors* in Column (1) and the significant ones of *Independent_directors* and *Ind_square* in Column (2). Also, the turning point in the over-investment group is 0.466, which is similar to that in the full sample. It implies that independent directors start to play a decisive role in reducing excess investments when more than 46.6% of directors on the corporate board are independent. Columns (3) and (4) report the empirical result in the under-investment group. The coefficient of *Independent_directors* and *Ind_square* is not significant in this group. This shows that a sufficient proportion of independent directors has a more significant positive function of monitoring and an advisory role in reducing excess investments rather than mitigating insufficient ones.

For the control variables in these two groups, it emerges that larger listed CEs have better investment efficiency in both the over- and under-investment groups, as the negative coefficient of *Firmsize* in all related models is significant at the level of 10%. This is consistent with the finding in the main regression. In addition, in the main regression, it is found that mature listed CEs have more experience in controlling their investments at the optimal level. The result relating to *Firmage* in Table 4-8 provides further evidence that mature listed CEs perform better in reducing excess investments, rather than mitigating insufficient investment, as the coefficient of *Firmage* is only significant in the over-investment group. Furthermore, in the main regression, it was elicited that the chairman of the corporate board concurrently holding the position of CEO is positively related to investment efficiency. The same evidence is found in the under-investment group, as the negative coefficient of *Ceo_duality* in Column (4) is significant at the level of 10%. It means that the chairman of the board and CEO being the same person can mitigate insufficient investments of listed CEs caused by lesser efficiency in board decision-making.

4.5.2 Does the performance of independent directors affect investment efficiency?

The main regression has proven that more independent directors on the corporate board lead to better investment efficiency. However, how they perform and whether their performance affects investment efficiency need more discussion. The performance of independent directors can be universally reflected by their attendance of board meetings (Harris and Shimizu, 2004). The main duty of the board of the directors is attending the board meetings and dealing with the major corporate strategies. In general, a Chinese listed firm has an average of eight board meetings per annum (Liao et al., 2009). A relatively good attendance record can guarantee independent directors gain sufficient financial and operating information about the firm they serve. Based on a better understanding of this essential information, the independent directors can fulfil their governance responsibilities. However, if they cannot attend the board meeting in person and delegate a representative to attend instead, access to such essential information may be blocked. Chou et al. (2013) document that the authorised board meeting attendance harms firm performance. Hence, the positive function of independent directors decreases in the presence of delegated representatives. Accordingly, this study proposes that the representative of independent directors weakens the effect of the latter on investment efficiency.

Even though it is a common phenomenon that independent directors appoint a representative to attend the board meetings, it is not a universal phenomenon in all listed firms. In this study, over half of the focal listed CEs were found not to have the presence of the representatives of independent directors. Moreover, various reasons may lead to the behaviour of independent directors designating a representative. Hence, this study chooses the Heckman selection model to avoid estimation bias and to investigate the determinants of the presence of the proxy. The first step is to test the reasons that may lead to the delegating behaviour of independent directors. Then, this study examines the relationship between the frequency of delegating a proxy and investment efficiency. The model is estimated by the maximum likelihood estimator and the selection bias is examined by Wald test. Equation (4.4) shows the selection model, and Equation (4.5) displays the second-stage regression:

$$Proxy1_{i,t} = \beta_0 + \beta_1 Ind\_number_{i,t} + \beta_2 Boardsize_{i,t} + \beta_3 Workplace_{i,t} + \beta_4 Payment_{i,t} + fixed\ effects\ of\ industry\ and\ year + \varepsilon_{i,t} \quad (4.4)$$

$$Abs\_INVEFF_{i,t} = \beta_0 + \beta_1 Proxy_{i,t} + \beta_2 Fees_{i,t} + \beta_3 Ceo\_duality_{i,t} + \beta_4 Boardsize_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Firmsize_{i,t} + \beta_7 Firmage_{i,t} + \beta_8 Listexg_{i,t} + fixed\ effects\ of\ industry\ and\ year + \varepsilon_{i,t} \quad (4.5)$$

where *Proxy1* in Equation (4.4) is the indicator variable for the presence of a proxy. It equals 1, if the representative of independent directors exists, and 0, otherwise. *Ind_number* is the number of independent directors on the corporate board. *Boardsize* is the total number of board members. *Workplace*, a dummy variable, shows whether independent directors have the same base with the firm they serve. This variable is measured to ascertain whether an independent director with an accounting background is in the same place as the listed firm. It equals 1, if at least one of the independent directors with an accounting background is in the same place as the firm they serve, and 0, otherwise. *Payment* is the average annual allowance for independent directors on the corporate board. The fixed effects of industry and year are controlled for at this step as well. According to the literature, more independent directors on the corporate board, a large board, different workplace and high payment may lead to a high probability of the presence of the representative of independent directors.

The independent variable (*Proxy*) in Equation (4.5) is an average figure of independent directors on the corporate board. It is measured by the number of times the independent directors delegated others to attend board meetings over the number they should have participated in during a year. For this part, the same control variables as for the main regression specification (Equation (4.2)) are applied as well as the controls for the industry and year fixed effects.

Column (1) of Table 4-9 displays the probit results of the first-stage of the Heckman selection model using the full sample. As expected, the number of independent directors has a significant positive relationship with the presence of the representatives of independent directors. When there are more independent directors on the corporate board,

there may be a higher probability that they will delegate a representative to attend the board meetings. This is because they may be of the viewing that it does not matter whether he or she attends the board meeting in person, as there are many independent directors on the corporate board already. The positive coefficient of *Boardsize* is close to the significant marginal level, thus showing a larger corporate board leads to a higher probability of the presence of representatives of the independent directors. Lin et al. (2013) provide support for the view that more people on the corporate board leads to lower attendance of board meetings. In addition, the payment of independent directors has a significant relationship with the presence of representatives of independent directors as well. The listed firms generally offer considerable remuneration to attract a person with a good social reputation, or rich experience, to be their independent directors. The average payment can indicate how professional and popular these directors are. As an independent director can serve more than one firm at the same time, the listed firm may share them with other firms. The "overboarded" directors result in weak corporate governance (Carpenter and Westphal, 2001; Fich and Shivdasani, 2006; Lei and Deng, 2014; Reguera-Alvarado and Bravo, 2017), through low board meeting attendance (Lin et al., 2013). Also, the annual allowance of independent directors in China is fixed instead of performance-related (Clarke, 2006). Tan et al. (2007) argue that this may bring adverse effects on the working motivation for independent directors. Last, *Workplace* does not provide significant effects on the presence of the representative of independent directors.

For the full sample, the Wald test proves the selection bias, where the hypothesis (rho=0) is rejected at the 10% level (P-value is 0.069). Column (2) reports the regression of second-stage analysis for the full sample. The coefficient of *Proxy* is 0.053, which is significant at the 5% level. It is consistent with the prediction that the presence of the proxy weakens the investment efficiency of listed CEs. Also, it supports the result of the study taken by Lin et al. (2013) that higher board attendance can improve the performance of the firm.

The Heckman selection model is conducted for over- and under-investment groups, respectively, as well. Table 4-9, from Column (3) to (6) reports the regression results. The effect in the over-investment group is significant at the 10% level, which means

independent directors could not fulfil their positive function of reducing excessive investment if they designated a proxy to attend the board meetings frequently. In addition, the P-value of the Wald test in the over-investment group is 0.023, indicating that there is selection bias issue if this study directly tests the relationship between board meeting attendance and investment efficiency. However, for the under-investment group, the P-value of the Wald test outcome means that the hypothesis (rho=0) cannot be rejected. This implies that there is no selection bias issue in the under-investment group. Also, the coefficient of *Proxy* is significant at the 10% level as well, which provides evidence that the presence of the representative of independent directors affects the investment efficiency of listed CEs that have under-investment issues.

4.5.3 Do the characteristics of independent directors affect investment efficiency?

Not only does the number of independent directors on the board influence investment efficiency, for their characteristics, such as gender and age, may impact on investment efficiency as well. That is, as Reguera-Alvarado and Bravo (2017) suggest, certain characteristics relating to the independent directors can influence their behaviours. Hence, this subsection investigates the effects of gender and age diversity on investment efficiency in listed CEs, respectively.

Previous literature has found that women on the board have a positive function on financial decision-making (i.e. acquisitions and debt issuing), firm performance, voluntary corporate social responsibility (CSR) disclosure and shareholder value maximisation. This is because they are relatively not overconfident and have better performance regarding the monitoring role than their male counterparts (Adams and Ferreira, 2009; Huang and Kisgen, 2013; Levi et al., 2014; Liu et al., 2014; Nekhili et al., 2017). Hence, this study predicts that the gender diversity of independent directors may bring about a positive effect on investment efficiency as well.

Kim and Lim (2010) argue that age can be a proxy for either the activity level or the experience of directors. Younger directors are more active in fulfiling their duties, while elder ones are more experienced in dealing with all kinds of affairs in firms (Kim and Lim, 2010; Tuggle et al., 2010). Moreover, Ali et al. (2013) discuss how age diversity may bring positive effects, whereby a firm can have wiser strategic decision-making by taking advantages of both younger and older directors. Meanwhile, age diversity may also bring negative effects, since there may be more dissatisfaction and conflict among directors of different ages. Hence, when independent directors vary in age (age diversity), it may have either a positive or negative association with investment efficiency. The regression employed to examine the effect of characteristics diversity of independent directors on investment efficiency is specified below:

$$Abs\_INVEFF_{i,t} = \beta_0 + \beta_1 Diversity_{i,t}(Gender\ or\ Age) + \beta_2 Fees_{i,t} + \beta_3 Ceo\_duality_{i,t} + \beta_4 Boardsize_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Firmsize_{i,t} + \beta_7 Firmage_{i,t} + \beta_8 Listexg_{i,t} + fixed\ effects\ of\ industry\ and\ year + \varepsilon_{i,t} \quad (4.6)$$

where *Gender* evaluates the proportion of female independent directors on the corporate board, which is measured by the number of female independent directors over their total number on the corporate board. *Age* is measured by the standard deviation of the age of independent directors on the board scaled by their mean age (Ali et al., 2013). For this regression, the same collection of control variables as with the main regression specification (Equation (4.2)) is applied as well as controlling for fixed effects of industry and year. This study also examines the impact between independent directors' characteristic diversity and investment efficiency under different investment inefficiency groups.

The test results of how the gender diversity of independent directors affects investment efficiency in listed CEs in the full sample as well as the over- and under-investment groups are tabulated in Table 4-10 from Columns (1) to (3), respectively. Moreover, the results for the effect of the age diversity of independent directors on investment efficiency are shown in Columns (4) to (6), respectively.

Whilst Liu et al. (2014) find that having female directors on the board improves firm performance through the executive role (female executive directors) rather than the monitoring one (female independent directors), this study provides evidence that female independent directors can significantly improve investment efficiency, especially in the over-investment group. This implies that female independent directors enhance the quality of investment efficiency, in particular, in over-investment scenarios. Specifically, in Column (1), the coefficient of *Gender* (-0.0103) indicates a significant positive relationship between the fraction of female independent directors and investment efficiency at the 10% level, which means that they can improve the investment efficiency. The over-investment group provides more substantial evidence of this, as the coefficient of female director ratio is significant at the 1% level; however, no significant evidence is found for the under-investment group.

The coefficient of *Age* is only significant in the over-investment group at the 10% level. This suggests that the age diversity of independent directors helps reduce excess investments, by taking advantage of advanced professional knowledge and a high activity level from younger independent directors and the valuable experience from the older ones. However, there is no significant evidence in the full sample and the under-investment group.

4.5.4 Extra control by the ultimate owner and the effect of independent directors on investment efficiency

The control power of the ultimate owner cannot be neglected, especially for listed CEs. As previously explained, the central government is the ultimate owner of listed CEs and authorises the management right to the central enterprises, which generally are the parent firm of listed CEs. In fact, as the ultimate owner, the central government and the central enterprises have a powerful influence over the major decision-making of listed CEs, no matter the size of the percentage of the equity owned by them. In general, the voting rights of the central government equal its cashflow rights. However, when these rights exceed the cash-flow rights held by the central government, the central enterprises exercise extra control on listed CEs. Shleifer and Vishny (1994), Shleifer et al. (1996), and Hart et al. (1997) argue that SOEs deviate from economic efficiency owing to the pursuit of political objectives by or lesser incentive for government agents. When the central enterprises have extra control over listed CEs, they are more likely to transfer resources from the latter to the parent firm or other affiliations in the group (Claessens et al., 2002), so that they can meet the political and financial targets set up by the superior governmental departments. In order to test whether this extra control from the central enterprises affects the relationship between independent directors and the investment efficiency of listed CEs, the main regression is repeated in groups, that is, with or without extra control. Moreover, this study extends the test to the groups of over- and under-investment. If the separation of voting and cash-flow rights from the central government is above 1, then this listed CE is classified into the group that has extra control from the central enterprises, whilst if the cash-flow rights equal the voting rights, then it is in the group without extra control.

Panel A of Table 4-11 reports the number and percentage of listed CEs experiencing extra control from the central enterprises in years and different investment inefficiency groups. Separating control and ownership is the common way that the central enterprises exercise excess control on their listed subsidiaries, with the proportion of listed CEs having this extra control being around 40%. Comparing the fraction of listed CEs with extra control in over- and under-investment groups, it is found that more listed CEs with over-investment issues have extra control from the central enterprises. When broken down into years, there is no significant difference among listed CEs of extra control regarding the number and percentage from 2012 to 2016.

Columns (1) and (2) in Panel B, Table 4-11, show the regression results of the effect of excess control by the central enterprises on the full sample. Comparing the regression results with or without this extra control, it can be seen that, extra control from the central enterprises blocks the function of independent directors, as there is no significant relation between independent directors and investment efficiency in the extra control group, no matter whether or not these directors hold the majority of seats on the corporate board. However, the result for the group without extra control is a consistent result with that for the main regression. This result also supports the negative effect of the separation of voting and cash-flow rights (extra control through the ownership structure), which is widely considered as being proxy for the potential expropriation of minority shareholders (Claessens et al., 2000). Columns (3) and (4) in Panel B, Table 4-11, show the regression results for the effect of excess control from the central enterprises on the over-investment group. When the listed CE is subject to extra control, the independent director system becomes a non-effective mechanism for reducing excess investments, as there is no significant relationship between independent directors and investment efficiency. For the group without extra control, the result is consistent with the finding in the main regression, which provides a U-shaped relation between independent directors and investment efficiency as well. Columns (5) and (6) in Panel B, Table 4-11, show the regression results of the effect of excess control by the central enterprises in the under-investment group. In the previous section, there is no relation between independent directors and investment efficiency in listed CEs with insufficient investment issues. At the same time, no significant effect of extra control on this relationship has emerged.

4.6 Discussion

This study has shown evidence on the effect of the independent director system on investment efficiency in a sample of non-financial A-share listed CEs from 2012 to 2016. A U-shaped relation has been found between independent directors and investment efficiency in listed CEs. This study also reports that it is a unique phenomenon for listed CEs, as no significant evidence has been found in listed non-CEs with similar characteristics to listed CEs. Having more independent directors on the board brings a negative effect on investment efficiency, especially when their proportion does not reach the critical mass point (47.3%). This is because firstly adding new faces to the corporate board may lead to a passive reaction from the existing executive directors and the affiliated directors from the controlling shareholder, as steward theory argues that, in this situation, the existing members on the corporate board think that they are not be trusted. Secondly, the voice of the independent director team is still too weak to against it. Overall, in this situation, the adverse effect of adding more independent directors on the corporate board exceeds the benefit of that, so investment efficiency is weakened correspondingly. However, when the proportion of independent directors exceeds the critical mass (47.3%), having more on the corporate board starts to play the positive role of improving the investment efficiency of listed CEs. For now, the independent director team is strong enough to diminish the other voices on the corporate board.

In addition, this study extends the main regression to over- and under-investment groups. It has been elicited that there is a U-shaped relationship between independent directors and investment efficiency in listed CEs with over-investment issues, but no significant evidence has been found for those with insufficient investment issues. This means that the independent directors play a more substantial role in reducing excess investments in listed CEs. Furthermore, it has emerged that a high frequency of independent directors delegating a representative to attend the board meetings harms firm investment efficiency in all listed CEs. Moreover, the gender diversity of the independent director team has a positive relation with investment efficiency in the full sample and the over-investment group. In contrast, the age diversity of independent directors is only significantly positively related to investment

efficiency in over-investment firms. Extra control by the central enterprises has a negative effect on the relationship between independent directors and investment efficiency. Overall, this study concludes that, the independent director system can improve the investment efficiency of listed CEs, especially in terms of mitigating the over-investment issue, when there are enough such directors on the corporate board.

The findings of this study add new evidence to the literature on investment, by examining whether the independent director system is able to be an effective mechanism for avoiding deviation from the optimal investment level of listed firms. Also, the outcomes have shown that independent directors can improve investment efficiency when their proportion exceeds the critical mass. The focus has been on listed CEs due to their particularity (strong connection with the central government) and importance (monopoly and important industries). It is suggested that it is necessary for listed CEs to have an efficient corporate governance mechanism in relation to investment efficiency, thereby ensuring their healthy and rapid development. The findings also have political implications for the regulator. As noted, the empirical results report a turning point of the independent director ratio (0.473) that is higher than the current mandatory proportion of independent directors (one-third). This is evidence that should be considered by the government for improving the independent director system, such as regulating that at least half of the directors on the corporate board should be independent for listed CEs. The study findings, overall, have enhanced the understanding of the independent director system and investment efficiency of listed CEs.

Table 4-1 Summary of variable definitions

	Variables	Variable description
Dependent variables	Abs_INVEFF	The absolute residual values of the investment efficiency model (Equation (4.1)).
Independent variables	Independent_directors	The ratio of independent directors to the total number of directors on the board.
	Ind_square	The quadratic term of the proportion of independent directors on the corporate board.
Control variables	Fees	Management fees scaled by annual income
	Ceo_duality	A dummy variable that equals 1, if the CEO also holds the position of the chairman of the board and 0, otherwise.
	Boardsize	Total number of directors on the corporate board.
	Leverage	The ratio of total debt to total assets.
	Firmsize	The natural logarithm of total assets.
	Firmage	Number of years since the listed CE went on public.
	Listexg	An indicator variable that equals 1, if the listed CE is on the Shanghai Stock Exchange and 0, if on the Shenzhen Stock Exchange.

This table shows the definition of the variables employed in the main regression. The data on governance and accounting variables are collected from CSMAR.

Table 4-2 Related descriptive statistics

Panel A: regression result of the investment model

VARIABLES	Dependent variable (INV_t) (1)
Investment opportunities$_{t-1}$	0.00210
	(0.00138)
Leverage$_{t-1}$	-0.0183***
	(0.00677)
CF_{t-1}	0.0382*
	(0.0209)
Firmage$_{t-1}$	-0.000553*
	(0.000317)
Firmsize$_{t-1}$	0.00231**
	(0.00114)
Return$_{t-1}$	0.00783**
	(0.00378)
INV_{t-1}	0.474***
	(0.0563)
Constant	0.0237***
	(0.00899)
Industry FE	YES
Year FE	YES
Observations	979
Adjusted R-squared	0.344

Panel B: Summary statistics of over- and under-investment groups in years

Year	2012	2013	2014	2015	2016	Total(N)
Over-investment group	80	77	78	76	65	376
% of sample firms	(39.4%)	(37.6%)	(39.6%)	(40.6%)	(34.8%)	(38.4%)
Under-investment group	123	128	119	111	122	603
% of sample firms	(60.6%)	(62.4%)	(60.4%)	(59.4%)	(65.2%)	(61.6%)
Total (N)	203	205	197	187	187	979

Panel C: Descriptive statistics of variables

Variable	Obs	Mean	Std	Min	Median	Max
Abs_INVEFF	979	0.0240	0.0312	0.00000618	0.0162	0.500
Over_INVEFF	376	0.0313	0.0435	0.000121	0.0198	0.500
Under_INVEFF	603	-0.0195	0.0188	-0.178	-0.0153	-0.00000618
Independent_directors	979	0.371	0.0606	0.231	0.333	0.714
Fees	979	0.0772	0.0616	0.00223	0.0667	0.612
Ceo_duality	979	0.0562	0.230	0	0	1
Boardsize	979	9.377	1.942	4	9	16
Leverage	979	0.531	0.196	0.0587	0.542	0.979
Firmage	979	14.347	4.482	2	15	24
Firmsize (billion/ RMB)	979	54.098	205.385	0.307	8.291	2405.38
Listexg	979	0.696	0.460	0	1	1

Panel A reports the regression results of the investment model, which are used to calculate the investment efficiency of listed CEs. *INV* is the investment expenditure in the year, which is measured by the difference between the cash payments for fixed assets, intangible assets, and other long-term assets as well as the cash receipts from selling those assets, scaled by the beginning total assets. *Investment opportunities* is represented by Tobin's Q, which is calculated from the market value of equity and net debt over total assets. *Leverage* is measured by total debt over total assets. *CF* is the net operating cash flow from the cash flow statement scaled by the beginning total assets. *Firmage* is the number of years that the firm is publicly listed on the stock market. *Firmsize* is the natural logarithm of total assets. *Return* is the annual individual stock return with cash bonus.

The robust standard error of each coefficient is shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Panel B reports statistics on over- and under-investment firm in years.

Panel C reports statistics of the main variables used in the study. *Over_INVEFF* and *Under_INVEFF* are the signed residual values of the over- and under-investment groups, respectively. For the specific definitions of the other variables refer to Table 4-1.

Table 4-3 Correlation matrix

		1	2	3	4	5	6	7	8
1	Independent_directors	1							
2	Fees	0.048	1						
3	Ceo_duality	0.167***	-0.035	1					
4	Boardsize	-0.316***	-0.202***	-0.114***	1				
5	Leverage	-0.003	-0.212***	0.006	0.194***	1			
6	Firmsize	0.131***	-0.260***	-0.078**	0.312***	0.421***	1		
7	Firmage	-0.144***	0.065**	0.003	-0.124***	-0.021	-0.212***	1	
8	Listexg	-0.051	0.030	-0.051	0.171***	0.060*	0.163***	-0.391***	1
	N	979							

Table 4-3 reports the Pearson correlation matrix among the independent variable and control variables employed in the study. The description of variables refers to Table 4-1. *** p<0.01, ** p<0.05, * p<0.1.

Table 4-4 The effect of the independent director ratio on overall investment efficiency

	Dependent variable (Abs_INVEFF)	
	Linear relationship	Non-linear relationship
VARIABLES	(1)	(2)
Independent_directors	0.021	0.292***
	(0.018)	(0.109)
Ind_square		-0.309***
		(0.113)
Fees	-0.019	-0.021
	(0.023)	(0.023)
Ceo_duality	-0.006*	-0.005*
	(0.003)	(0.003)
Boardsize	0.000339	0.000405
	(0.000737)	(0.000730)
Leverage	-0.006	-0.006
	(0.008)	(0.008)
Firmsize	-0.002*	-0.002*
	(0.001)	(0.001)
Firmage	-0.000581*	-0.000577*
	(0.000325)	(0.000322)
Listexg	0.003	0.003
	(0.003)	(0.003)
Constant	0.033**	-0.024
	(0.013)	(0.027)
Industry FE	YES	YES
Year FE	YES	YES
Observations	979	979
Adjusted R-squared	0.011	0.014
Cluster	Firm	Firm

The table reports OLS regression results with fixed effects from industry and year.
For the specific description of the variables, please refer to Table 4-1.
The standard errors are clustered by firm.
The robust standard error of each coefficient is shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4-5 Sensitivity tests

	Dependent variable (Abs_INVEFF)		
	Alternative INVEFF measure	Alternative INVEFF model	Piecewise linear regression
VARIABLES	(1)	(2)	(3)
Independent_directors	0.294***	0.295*	
	(0.113)	(0.166)	
Ind_square	-0.318***	-0.353**	
	(0.116)	(0.169)	
Independent_directors (under 0.473)			0.070**
			(0.030)
Independent_directors (above 0.473)			-0.092***
			(0.030)
Fees	-0.026	-0.023	-0.021
	(0.024)	(0.015)	(0.023)
Ceo_duality	-0.005*	0.000647	-0.005*
	(0.003)	(0.007)	(0.003)
Boardsize	0.000289	-0.000663	0.000453
	(0.000763)	(0.000740)	(0.000725)
Leverage	-0.004	0.002	-0.005
	(0.008)	(0.008)	(0.008)
Firmsize	-0.002*	0.000634	-0.002*
	(0.001)	(0.001)	(0.001)
Firmage	-0.000525	-0.0000215	-0.000590*
	(0.000335)	(0.000426)	(0.000320)
Listexg	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)
Constant	-0.020	-0.022	0.016
	(0.027)	(0.041)	(0.015)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	880	1,038	979
Adjusted R-squared	0.010	0.020	0.016
Cluster	Firm	Firm	Firm

The table reports the OLS results of sensitivity tests related to the main regression with three alternative methods. In Column (1), investment efficiency is computed by removing decile observations around the zero residual of Equation (4.1). In Column (2), investment efficiency is measured from an alternative investment model, which is a function of annual revenue growth rate, a dummy variable of controlling the positive or negative increase of revenue, and their interaction term. Column (3) employs the piecewise linear regression to test the U-shaped relation between independent directors and investment efficiency. *Independent_directors (under 0.473)* equals the proportion of independent directors, if it is under 0.473, and equals 0.473, otherwise. *Independent_directors (above 0.473)* equals 0 if it is under 0.473 and equals the proportion of independent directors minus 0.473 if it is over this figure. All regressions absorb the multiple fixed effects of industry and year. Same control variables are employed in all robust tests.

For the specific description of variables, please refer to Table 4-1.

The standard errors are clustered by firm, which is shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 4-6 Regressions that address the potential endogeneity issue

	Lagged independent director variables	IV-GMM		
	Abs_INVEFF	Independent_directors	Ind_square	Abs_INVEFF
VARIABLES	(1)	(2)	(3)	(4)
Independent_directors	0.335**			3.420**
	(0.150)			(1.617)
Ind_square	-0.358**			-3.618**
	(0.158)			(1.799)
HEIs		0.150**	0.132**	
		(0.060)	(0.053)	
HEIs_square		-0.024***	-0.021***	
		(0.009)	(0.008)	
Senior		0.015	0.014*	
		(0.010)	(0.009)	
Account		0.008	0.004	
		(0.018)	(0.017)	
Fees	-0.044*	0.044	0.029	-0.063*
	(0.026)	(0.049)	(0.044)	(0.036)
Ceo_duality	-0.007**	0.039	0.037	-0.0036
	(0.003)	(0.024)	(0.024)	(0.012)
Boardsize	-0.00000366	-0.012***	-0.010***	0.004
	(0.000827)	(0.002)	(0.001)	(0.003)
Leverage	-0.002	-0.006	-0.003	0.000534
	(0.010)	(0.015)	(0.013)	(0.011)
Firmsize	-0.003**	0.009***	0.007***	-0.005*
	(0.001)	(0.002)	(0.002)	(0.003)
Firmage	-0.000608	-0.002**	-0.002**	-0.0000476
	(0.000392)	(0.000909)	(0.000817)	(0.000589)
Listexg	0.003	-0.013*	-0.013*	0.002
	(0.003)	(0.008)	(0.007)	(0.005)
Constant	-0.025	0.261***	0.041	-0.746**
	(0.035)	(0.086)	(0.075)	(0.361)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	741	979	979	979
Cluster	Firm	Firm	Firm	Firm

The table reports the results of addressing the potential endogeneity issue in this study.

Column (1) displays the OLS results of replacing independent variables with one-year lagged data. *Independent_directors* is the lagged independent director ratio, and *Ind_square* is the quadratic term of the lagged independent director ratio.

Columns (2) to (4) report the regression results employing the IV-GMM approach. Specifically, Columns (2) and (3) are the regression results of the first stage. *Independent_directors* and *Ind_square* are estimated, respectively by the regression with excluded IVs (*HEIs, HEIs_square, Senior*, and *Account*) and control variables in the main regression specification. Column (4) reports the regression results of the second stage, where the independent variables are the estimated values derived from the first stage.

For the excluded IVs, *HEIs* means the number of HEIs in the same province of listed CEs, measured by the natural log of the number of HEIs in each province. *HEIs_square* is the quadratic term of *HEIs*. *Senior* is an indicator variable, which equals 1, if the number of people in HEIs having a senior professional title in that province is over the nationwide level, and 0 if otherwise. *Account* is an indicator variable as well, where 1

means that the province has more than three branches of the big-12 accounting firms, 0 means not.
For the specific description of the control variables, please refer to Table 4-1.
All regressions control the multiple fixed effects of industry and year.
R^2 is not reported, as it has no statistical meaning in the case of 2SLS/IV estimation method.
The standard errors are clustered by firm and shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4-7 Propensity score matching method

Panel A: statistics of the main variables after matching

Variables	Mean (listed non-CEs)	Mean (listed CEs)	MeanDiff
Abs_INVEFF	0.038	0.024	0.014***
Independent_directors	0.37	0.371	-0.001
Fees	0.08	0.077	0.003
Ceo_duality	0.044	0.056	-0.012
Boardsize	9.29	9.377	-0.087
Leverage	0.516	0.531	-0.015
Firmsize	4.686	4.66	0.026
Firmage	14.592	14.347	0.245
Listexg	0.706	0.696	0.01
Observations	979	979	

Panel B: Independent directors and investment efficiency in **matched listed non-CEs**

	Dependent variable (Abs_INVEFF)	
	Linear relationship	Non-linear relationship
VARIABLES	(1)	(2)
Independent_directors	0.007	0.179
	(0.032)	(0.363)
Ind_square		-0.203
		(0.404)
Fees	0.025	0.025
	(0.060)	(0.06)
Ceo_duality	-0.015***	-0.015***
	(0.005)	(0.005)
Boardsize	0.002	0.002
	(0.001)	(0.001)
Leverage	0.036**	0.036**
	(0.018)	(0.018)
Firmsize	-0.006***	-0.006***
	(0.002)	(0.002)
Firmage	0.000140	0.000154
	(0.000403)	(0.000398)
Listexg	-0.012*	-0.012*
	(0.006)	(0.006)
Constant	0.032*	-0.005
	(0.018)	(0.076)
Industry FE	YES	YES
Year FE	YES	YES
Observations	979	979
Adjusted R-squared	0.062	0.061
Cluster	Firm	Firm

Panel A reports the mean of the main variables in the listed non-CE and CE groups as well as the difference of means in those two groups, as examined by a T-test.

Panel B displays the OLS results of effects of independent directors and investment efficiency in matched listed non-CEs. The regression absorbs the multiple fixed effects of industry and year. Same control variables are employed in all related tests.

For the specific description of variables, please refer to Table 4-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 4-8 The effect of independent directors on over- and under-investment

	Dependent variable			
	Over_INVEFF		Under_Abs_INVEFF	
VARIABLES	(1)	(2)	(3)	(4)
Independent_directors	0.050	0.582**	0.016	0.129
	(0.039)	(0.227)	(0.014)	(0.108)
Ind_square		-0.628**		-0.127
		(0.245)		(0.111)
Fees	-0.022	-0.032	-0.009	-0.00997
	(0.067)	(0.068)	(0.014)	(0.0135)
Ceo_duality	-0.010	-0.007	-0.005*	-0.00448*
	(0.008)	(0.007)	(0.002)	(0.002)
Boardsize	0.000754	0.000907	0.0000196	0.0000441
	(0.002)	(0.002)	(0.000541)	(0.000538)
Leverage	0.006	0.006	-0.010	-0.009
	(0.018)	(0.018)	(0.006)	(0.006)
Firmsize	-0.004	-0.004*	-0.001*	-0.001*
	(0.002)	(0.002)	(0.000848)	(0.000852)
Firmage	-0.001*	-0.001*	-0.000360	-0.000355
	(0.000689)	(0.000680)	(0.000251)	(0.000252)
Listexg	0.003	0.002	0.003	0.003
	(0.006)	(0.006)	(0.002)	(0.002)
Constant	0.038	-0.071	0.029***	0.005
	(0.028)	(0.054)	(0.009)	(0.027)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	376	376	603	603
Adjusted R-squared	-0.003	0.002	0.026	0.026
Cluster	Firm	Firm	Firm	Firm

The table reports the OLS regression results with the multiple fixed effects from industry and year.
The specific description of the variables, please refer to Table 4-1. The standard errors are clustered by firm. The robust standard error of each coefficient is shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4-9 The effect of independent director's performance on investment efficiency

	Proxy1	Abs_INVEFF	Proxy1	Over_INVEFF	Proxy1	Under_Abs_INVEFF
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Proxy		0.053**		0.084*		0.041*
		(0.022)		(0.043)		(0.024)
Control variables		YES		YES		YES
Ind_number	0.195*		0.012		0.271**	
	(0.104)		(0.175)		(0.112)	
Boardsize	0.066		0.123*		0.046	
	(0.043)		(0.067)		(0.048)	
Workplace	-0.004		0.022		-0.044	
	(0.103)		(0.169)		(0.129)	
Payment	0.017**		0.028**		0.011	
	(0.009)		(0.013)		(0.011)	
Constant	-1.525***	0.040***	-1.536***	0.054**	-1.536***	0.0356***
	(0.391)	(0.010)	(0.562)	(0.022)	(0.456)	(0.0126)
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	917		353		564	
Observations_selected		428		168		260
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
ll		401.3		136.0		360.4
Wald Test (rho=0)	3.710		5.173		0.052	
P_value	0.054		0.023		0.820	

The table reports the Heckman selection model (MLE) results of independent directors' performance and investment efficiency. The dependent variable (*Proxy1*) in the probit model is the indicator variable for the presence of a proxy, where 1 means yes and 0, otherwise. *Independent_directors* means the number of independent directors on the corporate board. *Boardsize* is the total number of board members. *Workplace* is an indicator variable as to whether the independent director with an accounting background is in the same city as the firm that he/she serves. *Payment* is the average compensation of independent directors. *Proxy* in the second stage is an average figure measured by the number of times the independent directors delegate others to attend the board meetings scaled by the number of board meetings they should have participated in during a year. The specific description of the control variables in the second-stage, please refer to Table 4-1. In both stages, the fixed effects from industry and year are controlled. The standard errors are clustered by firm. The robust standard error of each coefficient is shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4-10 The effect of characteristics diversity of independent directors on investment efficiency

	Gender diversity			Age diversity		
	Abs_INVEFF	Over_INVEFF	Under_Abs_INVEFF	Abs_INVEFF	Over_INVEFF	Under_Abs_INVEFF
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Diversity (Gender/Age)	-0.010*	-0.027***	0.001	-0.026	-0.073*	0.003
	(0.006)	(0.010)	(0.004)	(0.016)	(0.040)	(0.010)
Control variables	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	967	369	598	969	368	601
Adjusted R-squared	0.012	0.005	0.018	0.012	0.008	0.021
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

The table reports the OLS regression results absorbing the fixed effects of year and industry. *Gender* means how many independent directors on the board are female, which is measured by the number of female independent directors over their total number on the board. *Age* is age diversity, measured by the standard deviation of the age of independent directors on the board scaled by the mean age of a firm's independent directors.

The specific description of the control variables, please refer to Table 4-1.

The standard errors are clustered by firm.

The robust standard error of each coefficient is shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Table 4-11 Extra control by the ultimate owner and the effect of independent directors on investment efficiency

Panel A: summary statistics of the extra control from the ultimate owner in years

Year	2012	2013	2014	2015	2016	Total
Listed CEs with the extra control (N)	80	82	78	77	78	395
% of full sample	(39.4%)	(40%)	(39.6%)	(41.2%)	(41.7%)	(40.4%)
In over-investment group (N)	34	35	31	34	30	164
% of over-investment group	(42.5%)	(45.6%)	(39.7%)	(44.7%)	(46.2%)	(43.6%)
In under-investment group (N)	46	47	47	43	48	231
% of over-investment group	(37.4%)	(36.7%)	(39.5%)	(38.7%)	(39.3%)	(38.3%)

Panel B: Extra control by the ultimate owner and the effect of independent directors on investment efficiency

	Abs_INVEFF		Over_INVEFF		Under_Abs_INVEFF	
	Extra_control=0	Extra_control=1	Extra_control=0	Extra_control=1	Extra_control=0	Extra_control=1
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Independent_directors	0.297**	0.182	0.730**	0.435	0.158	0.127
	(0.137)	(0.238)	(0.306)	(0.392)	(0.135)	(0.311)
Ind_square	-0.313**	-0.172	-0.776**	-0.428	-0.149	-0.151
	(0.139)	(0.272)	(0.326)	(0.433)	(0.138)	(0.380)
Control variables	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	583	395	211	164	372	231
Adjusted R-squared	0.024	0.029	0.048	0.020	0.028	0.038
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Panel A reports the statistics of extra control from the ultimate owners in years.

Panel B reports the OLS regression results absorbing the multiple fixed effects of industry and year. *Extra_control* is an indicator variable of the presence of extra control from by the ultimate owner through the ownership structure, which is measured by whether or not the voting rights exceed the cash-flow rights owned by the ultimate owner. It equals 1, if the separation of voting rights and cash-flow rights is over 1 and 0, otherwise. The regression model has the same control variables as the main one, and the description of variables is that of those in Table 4-1. The robust standard errors are clustered by firm, which is shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Chapter 5 (Study 3) The Supervisory Board and Financial Reporting Quality

5.1 Introduction

The current corporate governance structure in China is unique, being a mixture of the unitary board structure in the U.S. and the two-tier one in Germany. In the Chinese corporate governance system, shareholders of the company elect the board of directors (BOD) and the supervisory board (SB) during the shareholder's general meeting. These two boards are parallel, which is different from the German two-tier board system, where the supervisory board is superior to the board of directors[40]. The primary duty of the supervisory board is the monitoring function (the *Corporate Law* 1993). The supervisory board monitors the behaviour of the corporate board and the executives as well as monitoring the financial affairs of the company on behalf of the shareholders. In addition, similar to the U.S. unitary board system, the Chinese government implemented the independent director system on the corporate board in 2001. The independent directors on the board are authorised to monitor firm activities as well, so that they can protect the wealth of the firm and the interests of minority shareholders.

Given there are two monitoring systems (i.e. the independent directors on the corporate board and the supervisory board) in the Chinese corporate governance structure, the internal control of Chinese listed firms should be effective. However, the supervisory board in China is widely discussed as being dysfunctional or ineffective (e.g. Tam, 2000; Dahya et al., 2003). Also, this makes scholars, such as, Tam (1995), Tian (2001), and Chen and Al-Najjar (2012), argue that the corporate governance structure in China seems closer to the Anglo-American unitary board system. In the Chinese corporate governance system, it is essential to find out the mechanisms of the supervisory board to strengthen its monitoring function. Ran et al. (2015) employ a sample of Chinese non-financial listed firms (17,698 firm-year observations) from 1999 to 2012 to examine the relationship between the

[40] For instance, in the German corporate governance system, the shareholders' general meeting elects the board of supervisors, then, the supervisory board takes the role of appointing or removing the members of the corporate board. However, the shareholders' general meeting cannot make decisions about the board of directors directly.

characteristics of supervisors and financial reporting quality. They document that supervisors with an accounting or academic background, higher compensation, and more females can improve financial reporting quality in Chinese listed firms. For this study, the supervisory board is investigated from a different angle, that is, by seeking understanding of the effectiveness of the supervisory board in improving financial reporting quality in a specific type of state-owned enterprise (SOE), namely, the listed central enterprises (listed CEs) in China.

As one of the largest emerging markets, China is attracting more attention from the world. In China, state-owned shares still dominate the stock market even following the SOE reforms in 1978. It is clear that SOEs play an important role in the Chinese economy. Therefore, it is necessary to make sure that the corporate governance system in SOEs is healthy and effective. However, Li (2005) argues that the weak monitoring function of the supervisory board system in SOEs results in the loss of state assets. The executives falsify the financial statements, which leads to a lower quality of accounting information in SOEs. This problem turns out to be severer in listed CEs. This is because they have great influences on the safety and security of the country, as they are concentrated in industries such as defence, utilities, and natural resource. The potential loss of state assets in these fields caused by the malfunction of supervisory boards in listed CEs is harmful to the interest of the state.

This study involves examining the effect of the supervisory board on financial reporting quality in listed CEs from four aspects: supervisory board size, board composition, board characteristics and board incentives. A sample of 1,050 firm-year observations from 236 non-financial listed CEs from 2012 to 2016 is employed. As the change in the nature of listed CEs' ultimate owner has led to their number being different each year, this study has manually checked the status of listed CEs in the research period from the annual reports. In this study, a supervisor is defined as an affiliated supervisor, if he/she concurrently holds a position with the ultimate owner (i.e. the central enterprises on behalf of the central government) or its affiliations. The number of affiliated supervisors has been manually collected from the annual reports. Other supervisory board, corporate governance and

related financial information has been obtained from the Chinese Securities Market and Accounting Research (CSMAR). The major findings of this study are as follows.

First, supervisory board size has a positive relationship with financial reporting quality in listed CEs. That is, having more supervisors on the board can improve the financial reporting quality of listed CEs. Second, affiliated supervisors from the central enterprise or its affiliations harm the informativeness of earnings in listed CEs, because they suffer much severer political influences from the central government. The central enterprises may transfer resources from listed CEs to other non-listed and less profitable affiliations in the business group to meet the financial and political targets required by the central government. Moreover, the affiliated supervisors must be compliant with the parent firm (i.e. the central enterprise) and help it to conceal these potential expropriation behaviours. However, employee representatives on the supervisory board have no relation with financial reporting quality in listed CEs. Third, if a supervisory board contains supervisors that are older and/or at a similar age, the listed CEs have better financial reporting quality. This is indicated by the positive effect from average supervisory team age and the negative one from the age diversity of the supervisory board. The proportion of female supervisors on the board and financial reporting quality in listed CEs are in a U-shaped relationship. Specifically, a proportion of female supervisors exceeding 44.2% has a positive effect on improving financial reporting quality in listed CEs and before reaching this turning point, their proportion weakens financial reporting quality. Finally, the compensation of the supervisory board has no relationship with financial reporting quality. The main results from this study are robust, as shown by sensitivity testing consisting of different measurements of financial reporting quality as well as after controlling for potential endogeneity issues.

This study conducts two additional tests relating to this topic. First, there is an examination of the effect of extra control from the central enterprises[41] on the relationship between board composition and financial reporting quality. However, extra control from the central enterprises does not affect the relation between affiliated supervisors (employee representatives) and financial reporting quality in listed CEs, as the interaction term for the

[41] Extra control from the central enterprises means that the voting rights exceed the cash-flow rights owned by the central government.

two is insignificant. The second extended test examines whether firm size affects the impact of affiliated supervisors and employee representatives on financial reporting quality. It is elicited that larger firms can constrain the negative effect of affiliated supervisors on financial reporting quality in listed CEs. This is possible because the large listed firms are less likely to conduct earnings management due to better corporate governance, fewer information asymmetries, and more reliable monitoring from the external auditor as well as the financial analyst (Meek et al., 2007). Moreover, there is no influence of the size effect on the relationship between employee representatives and financial reporting quality in listed CEs.

The outcomes of this study lead to empirical and political contributions to the literature. They enrich the literature on the supervisory board in SOEs. Compared to Ran et al. (2015), who use a sample covering most non-financial listed firms in China, this study focuses on the characteristics of supervisory boards among listed CEs and obtains some novel results. For instance, this study finds a U-shaped relationship between female supervisors and financial reporting quality. This would appear to be a unique phenomenon to listed CEs, for Ran et al. (2015) state that there is a positive linear relationship between the two factors. This study outcomes also provide new evidence for the literature of financial accounting quality. Notably, some supervisory board factors can improve financial reporting quality in listed CEs, such as larger supervisory board size, a smaller proportion of affiliated supervisors, as well as when the supervisory team comprises lower ages and lower age diversity. Hence, this work has political implications in identifying ways to enhance the effectiveness of the supervisory board system in listed CEs.

The rest of the study proceeds as follows. Section 5.2 introduces the related literature and develops hypotheses. Section 5.3 provides the details of research methodology and data. Section 5.4 reports the main empirical findings and sensitivity tests. Section 5.5 presents the empirical results of extended tests. Section 5.6 concludes the results.

5.2 Literature review and hypothesis development

The current corporate governance system in Chinese firms is a combination of the German two-tier board system and the Anglo-American unitary board one. In China, the *Corporate Law* (1993) requires that all firms should adopt a two-tier board structure that includes a corporate management board (board of directors: BOD) and a supervisory board (SB). This resembles the governance structure in Germany. Meanwhile, the firms are regulated to have independent directors on the board, which follows the governance structure in the U.S.. Xi (2006) claims that the role of the supervisory board in Chinese firms is not the same as that in Germany. It is less powerful, as it does not have the right to appoint the executive directors and evaluate their performance (Schipani and Liu, 2002; Xiao et al., 2004; Ding et al., 2010). Moreover, the supervisory board in China does not have a hierarchical relationship with the board of directors. Shareholders elect both boards during the shareholders' general meeting (Chen and Al-Najjar, 2012). In the case of the two-tier board structure (the supervisory board is less powerful) and the weak legal system in China, the supervisory board is generally seen as being dysfunctional or ineffective (Tam, 2000; Dahya et al., 2003; Xiao et al., 2004). Furthermore, the ineffectiveness of the supervisory board makes the reform of China's corporate governance structure closer to the Anglo-Saxon unitary board system (Tam, 1995; Tian, 2001; Chen and Al-Najjar, 2012).

Dahya et al. (2002) conduct interviews with the directors, supervisors and senior executives in 16 Chinese listed firms, and summarise six main reasons leading to the ineffectiveness of supervisory boards in China: (1) lack of legal power and clearly defined legal responsibilities for the supervisory board; (2) lack of independence; (3) lack of technical expertise; (4) relatively lower status than the BOD and the senior executive officers; (5) limited access to information; and (6) lack of incentives. [42] Xiao et al. (2004) adopt the grounded theory methodology and put forward four types of roles played by the supervisory board in China: an honoured guest, a friendly advisor, a censored watchdog, and an independent watchdog[43]. They find that the supervisory board in most Chinese listed firms performs one

[42] See Dahya et al. (2002) for a detailed discussion.

[43] See Xiao et al. (2004) for a detailed discussion. Honoured guest means that the supervisory board pretends to comply with basic legal requirements, but in reality, it does little besides maintaining a mere physical

of the first three types, but very few, the last. Lin (2004) analyses the overall corporate governance in China and documents a consistent result that the monitoring role of the supervisory board in China is weak, in particular, because its functions are not clearly defined. In October 2005, the government amended *Corporate Law*, and the power of the supervisory board increased. For instance, the revised *Corporate Law* (2005) regulates that the supervisory board can propose the dismissal of directors or executives, has the right to sue the directors and executives, and can call external experts to assist it in undertaking the investigation and at the expense of the firm.

The above qualitative studies all agree that the Chinese supervisory board is not as effective as expected. Some empirical studies also document this argument. For instance, Wei (2007) fails to find evidence that the supervisory board has significant effects on firm performance, by using a sample of 276 Chinese non-financial listed firms from 1999 to 2002. Shan and McIver (2011) elicit that the proportion of experts with professional knowledge or a background in accounting or law on the supervisory board has no impact on corporate financial performance, as indicated by the evidence of Chinese non-financial listed firms from 2001 to 2005. Also, Shan and Xu (2012) find similar ineffectiveness and even adverse effects of the supervisory board in the Chinese financial sector. They state that the number of supervisory board meetings is negatively related to firm performance and supervisory board size does not affect it, by using a sample of listed financial sector firms in China from 1999 to 2009. Ding et al. (2010) investigate whether the amended *Corporate Law* (2005) has improved the monitoring role of the supervisory board on executive compensation. They find that the effect of supervisory board size and meeting frequency became significant on executive compensation in 2006 (the year that the revised *Corporate Law* was implemented). In 2006, when the number of supervisory board meetings was in the proper range (3 to 6 times per year)[44], more supervisory meetings helped to curb total executive

presence. Friendly advisor means that the supervisory team only provides consultancy and advices without confronting the directors on the corporate board and the executives, even when problems exist. Censored watchdog means that, the monitoring function of supervisory board is prevented from disseminating information in fear of reprisal from either a powerful corporate board or the executives. Independent watchdog means that the supervisory team can fulfil its monitoring duties "largely" independently.

[44] Ding et al. (2010) split Chinese listed firms in groups based on the number of supervisory board meetings they have in a year. They argue that, if the supervisory board has too few meetings in a year (e.g. two or less) so as just to meet the mandatory requirement from the regulation, it is ineffective and malfunctions. However,

compensation. In addition, large supervisory board size leads to high total executive compensation, but it lowers the pay-performance sensitivity. Overall, Ding et al. (2010) confirm the positive function of the amendments in the *Corporate Law* (2005), whereby it has strengthened the monitoring effects of the supervisory board.

One of the specific duties of the supervisory board defined by the *Corporate Law* (1993) is to review firm's financial affairs in order to monitor financial reports. The supervisory board has the responsibility to maintain the financial reporting quality of the firm, which is important for both existing shareholders and potential investors. This is because financial statements are the key channel for them to achieve a full understanding of the firm they are investing in and the target firm they potentially will invest in. Also, good financial reporting quality can reduce information asymmetry, which leads to a more transparent investment environment. Hence, it is necessary to examine the monitoring function of the supervisory board on financial reporting quality. The results in the existing literature on this topic with evidence from China are inconsistent. Firth et al. (2007) investigate whether the supervisory board affects the informativeness of earnings, using a sample of Chinese non-financial listed firms from 1999 to 2003. They find that larger and more active supervisory boards can improve the earnings-returns association, reduce absolute discretionary accruals, and have higher quality financial statements based on the auditor's opinion. Their results confirm the positive effect of supervisory boards on improving financial reporting quality. Jia et al. (2009) argue that supervisory boards do react and attempt to deal with the enforcement actions[45] caused by financial information fraud. To be specific, they find that listed firms with a large supervisory board are more likely to have more stringent sanctions from the China Securities Regulatory Commission (CSRC)[46] and they have more supervisory meetings when they face more severe enforcement actions. This study uses a sample of 362 fraud and 327

when there are too many (over six) meetings in a year, the monitoring costs of having them may outweigh the positive aspects.

[45] There are various available types of enforcement action imposed by CSRC caused by the fraudulent behaviours of listed firms, including an official warning, a monetary fine, the return of illegally raised proceeds, the confiscation of illegal income, the termination of share issuance, and the suspension or termination of securities trading qualifications.

[46] The Shanghai and Shenzhen Stock Exchanges and CSRC take the role of punishing the listed firm with financial fraud. Specifically, the two stock exchanges sanction listed firms with minor fraudulent activities, and CSRC deals with listed firm with more severe violations. Jia et al. (2009) argue that the agency that imposes sanctions is an accurate proxy for the severity level of the punishments.

matched non-fraud firm-year observations from 2001 to 2006. In contrast, Habbash et al. (2014) do not find significant evidence by examining the effect of the monitoring mechanisms (i.e. independent directors and supervisory board) in the corporate governance system on earnings management for Chinese listed firms from 2005 to 2010. Their results show that both independent directors and the supervisory board fail to constrain earnings management. As earnings management is a crucial determinant of financial reporting quality, the empirical evidence from Habbash et al. (2014) partially reflects the ineffectiveness of the supervisory board on financial reporting quality. Ran et al. (2015) comprehensively investigate the relationship between the supervisory board and accounting information quality, with their study involving different characteristics of the supervisory board. They suggest that the background of supervisors (especially with accounting or academic backgrounds), supervisor compensation and female supervisors are drivers of improvements in accounting information quality in Chinese listed firms.

Habbash et al. (2014) not only state that the monitoring mechanisms (i.e. independent directors on the corporate board and supervisors on the supervisory board) in Chinese listed firms fail to mitigate earnings management, but also, that SOEs are more likely to manipulate earnings than private firms. Wang and Wu (2011) find that SOEs tend to report poor quality financial reports and restate them later, with a sample of Chinese listed firms from 1999 to 2005. In contrast, Ding et al. (2007) investigate earnings management in SOEs and non-SOEs, documenting that the managers in the later have more pressure to manipulate earnings to stabilise their stock price in the capital market. Wang and Yung (2011) find similar evidence that SOEs are less likely to manage earnings and that they get robust results even after considering the potential effect of tunnelling activities taken by controlling shareholders (i.e. the government), which is widely regarded as a driver of earnings management in Chinese SOEs (Chen and Yuan, 2004; Aharony et al., 2010). As the evidence about the financial reporting quality of SOEs in the existing literature is inconsistent, it is necessary to examine whether the supervisory board is effective in improving the level of financial reporting quality in SOEs. Moreover, Firth et al. (2011) find that listed CEs have more financial reports restatements and they argue that the major reason is the lack of oversight taken by the government bureaucrats, and/or their efforts to show better-than-real financial statements to satisfy the requirements of the government.

Hence, for this study, the focus is on Chinese listed CEs and the effect of the supervisory board on financial reporting quality.

In line with Ran et al. (2015), this study investigates the supervisory board from multiple dimensions[47], in terms of the characteristics of the supervisory board that can mitigate its ineffectiveness and improve financial reporting quality in listed CEs.

5.2.1 Supervisory board size

The size of the supervisory board is the most common measure of its quality employed in the existing literature. Firth et al. (2007) report that it has a positive effect on improving the quality of accounting information in Chinese firms, in that a larger board can increase the earnings response coefficients in the earnings-returns relation model[48], reduce absolute discretionary accruals as well as the frequency of modified audit opinions. They argue that larger supervisory boards are more likely to have more members with an accounting background or related work experience, who can enhance the quality of the financial statements. Also, if there are more supervisors on the board, the supervisory board has stronger power to judge the executives' decisions and correct their potential earnings management behaviours efficiently. In China, the average number of members on the supervisory board is four (Firth et al., 2007; Ran et al., 2015), which is smaller than the threshold of board size that may result in board inefficiency in the unitary board system. Jensen (1993) suggests that the board cannot perform well when there are more than nine members on the board. In which case, the current supervisory board in China does not have an inefficient problem driven by it being too big. Hence, this study expects a positive function of a large supervisory board, and thus, the hypothesis proposed is:

[47] Frequency of supervisory board meetings, professional background of supervisors, and supervisor's ownership are popular variables when measuring the supervisory board as well. However, they are not included in this study due to the lack of the relevant information.

[48] Firth et al. (2007) argue that the informative earnings numbers derived from the accounting system should be reflected in stock returns. Their empirical results show that earnings are positively associated with stock returns, and the interaction term of earnings and the size of the supervisory board is positive and significant that the level of 5%. This implies that a larger supervisory board can enhance the informativeness of earnings numbers, such that it reflects in more stock returns.

H1: A larger size of the supervisory board can improve the financial reporting quality of listed CEs.

5.2.2 Supervisory board composition

Shareholder representatives are an essential component of the supervisory board. As widely discussed, Chinese firms are characterised by a highly concentrated ownership structure (Wei and Geng, 2008; Gul et al., 2010; Yu, 2013), with most shareholder supervisors being generally from the large shareholders or even the ultimate owner of the firm. The performance of those supervisors is affected by the purpose of this ultimate owner. In a concentrated ownership structure, the main conflict of interests is between the controlling and minority shareholders. Claessens et al. (2002) argue that the large shareholders of listed firms may have the incentive to align their profit to firm performance or to expropriate the resources from minority shareholders according to their ownership rights and the control rights. Claessens et al. (2002) use the evidence of eight East Asian economies and find that listed firms with higher cash-flow rights owned by the ultimate owner have higher valuations, while the difference between control and ownership (i.e. the difference between the voting rights and the cash-flow rights) reduces the corporate value of such firms. In this case, if the ultimate owner has higher cash-flow rights, the supervisors appointed by it are more likely to play a decisive role by avoiding falsified accounting information conducted by the executives to protect the interest of the ultimate owner. When the cash-flow rights significantly deviate away from the voting rights, the ultimate owner may divert resources away from listed firms, as the cost of tunneling activities that expropriate the wealth from the minority shareholders is relatively low. Under this circumstance, the affiliated supervisors may have no significant or negative effect on the firm's financial reporting quality, as they assist the ultimate owner in masking the accounting information relating to those tunneling activities. Another possibility is that the ultimate owner may prop up the listed firms (i.e. the ultimate owner transfers resources probably from other affiliations to the listed firms) to help them meet the equity issuance requirement or avoid delisting (Jian and Wong, 2008; Ying and Wang, 2013). Even though the propping up activities benefit the

minority shareholders, these activities result in earnings management as well, and lower overall financial reporting quality.

For listed CEs, the ultimate owner is the State-owned Assets Supervision and Administration Commission (SASAC). SASAC authorises the central enterprises to practise the management right on these listed CEs. The central enterprise groups are generally regarded as "state units", since they are wholly owned by the central government, and totally represents the interest of the government (Yeo, 2013). Hence, tunneling or propping up activities conducted by the ultimate owner on the listed CEs are generally politically oriented. For example, the central enterprises may transfer resources from listed CEs to non-listed affiliations in the business group in order to meet the overall financial target set up by the superior governmental institutions. Hence, the affiliated supervisors from the central enterprises bring political influence to listed CEs as well. It is necessary to examine how the affiliated supervisors from the central enterprises affect the informativeness of earnings in listed CEs. According to the literature, the affiliated directors from the ultimate owner are more likely to have negative impacts on financial reporting quality rather than positive. Hence, the first hypothesis of supervisory board composition is:

H2a: the affiliated supervisors from the central enterprises weaken the financial reporting quality of listed CEs.

Fauver and Fuerst (2006) use evidence from German supervisory boards and find that employee representatives play a positive role in monitoring the management and reducing agency costs in corporations. Moreover, they argue that such representatives on the board are the connection between the employees and the management team. With more credible information about a firm's strategies and profits delivered by the labour representatives on the supervisory board, the employees are more positive and confident about fulfiling the firm's mission. In China, as aforementioned, the revised *Corporate Law* (2005) regulates the basic composition of the supervisory board. To be specific, at least one-third of supervisory board members should be employee representatives. Ideally, this amendment empowers employees and provides them with more participating opportunities for corporate oversight.

However, the empirical evidence of the function of employee representatives in China is not significant. For instance, Ran et al. (2015) fail to find that the employee members on the supervisory board can improve the informativeness of earnings. Yang et al. (2017) focus on listed CEs from 2005 to 2014, investigating the function of employee representatives on the supervisory board on employees' compensation. They document that the employee representatives fail to increase the employees' income or to constrain the self-interest behaviour of the executives effectively. They also conduct a quasi-experimental approach, employing the regulation[49] carried out by SASAC in 2009 as the exogenous event and compare the performance of employee representatives on mitigating the difference in income between the junior employees and the top executives in the period before and after the regulation launched. Their results indicate that the change of labour seats on the supervisory board is just to meet the mandatory requirement of the regulation and the employee representation on the supervisory board in listed CEs is more likely to be for decoration only, with just nominal rights. Considering the current corporate governance environment in China, this study predicts that it is difficult for the employee representatives on the supervisory board to play a significant role in monitoring the management in order to improve financial reporting quality. Hence, the second hypothesis of supervisory board composition is that:

H2b: employee representatives on the supervisory board do not have significant effects on improving the quality of financial reporting in listed CEs.

5.2.3 Supervisory board characteristics

The age of members on the supervisory board is one of the characteristics that may affect its performance. In general, the older represents rich experience, whilst the younger has an open mind and energetic participation (Kim and Lim, 2010; Tuggle et al., 2010; Ran et al., 2015). As the primary role of the supervisory board is monitoring the financial affairs and operation of listed firms, which needs more related working experience, this study proposes that the older supervisors have a positive effect on the improvement of accounting

[49] Provisions on Central State-owned Enterprises' Support to the Supervisory Board for Monitoring in the Current Period (Trial), launched by SASAC in 2009.

information quality. To test for this, the average age of members on the supervisory board is measured and the hypothesis proposed regarding the average age of the supervisory team, is that:

H3a: the average age of the supervisory board is positively related to the financial reporting quality of listed CEs.

Supervisors on the supervisory board generally are at different ages. This age diversity may lead to either positive or negative effects. Regarding which, Ali et al. (2013) argue that boards with age diversity may have wiser strategic decision-making by taking advantage of both younger and older directors' different capabilities. However, there may be more dissatisfaction and conflict of interest among directors in the board with significant age diversity. The effect of age diversity on the informativeness of earnings may be significant, but the results are mixed. Hence, the hypothesis put forward is:

H3b: the age diversity of the supervisory board has significant effects on the financial reporting quality of listed CEs.

The function of female directors in corporate governance is widely discussed, but the studies about female supervisors are limited. Joecks et al. (2012) examine the function of female supervisors under the German two-tier board system, finding that the impact of gender diversity (i.e. more females on the supervisory board) of the supervisory board on corporate performance becomes positive when there are more than three women on the supervisory board. This result supports the magic number of three women on the board in recent studies (e.g. Konrad and Kramer, 2006; Kristie, 2011; Torchia et al., 2011). Dienes and Velte (2016) confirm the positive function of women in the German corporate governance system and document that gender diversity has a positive effect on corporate social responsibility (CSR) reporting. Similar evidence is found in China, such as, Ran et al. (2015) finding that more female supervisors on the board can play a positive monitoring role in improving financial reporting quality. Also, they suggest that women are more suitable for positions with the monitoring function, for example, being a supervisor on the supervisory

board, as they are more careful and risk averse compared to men. Based on the existing literature, it is contended here that, female supervisors are positively related to a firm's financial reporting quality. Hence, the hypothesis regarding gender diversity of the supervisory board is that:

H3c: more female supervisors on the board can improve the financial reporting quality of listed CEs.

5.2.4 Supervisory board incentives

As noted above, the lack of incentives leads to inefficient supervision of the supervisory board. Tian (2009) suggests that an assessment and incentive mechanism for the supervisory board is required, which could motivate the supervisors to fulfil their responsibilities. To be specific, compensation is a kind of economic incentive. Ran et al. (2015) find that supervisors with considerable compensation are more likely to fulfil the monitoring role and to improve the quality of financial statements. Thus, this study predicts that there is a positive impact of supervisory compensation on accounting information quality and, accordingly, the next hypothesis is that:

H4: higher supervisory compensation can improve the financial reporting quality of listed CEs.

5.3 Research design and data

5.3.1 Methodology and variables

(1) Financial reporting quality

There are several proxies for financial reporting quality. Chen et al. (2011a) suggest that a single proxy could not cover all drivers of financial reporting quality and may have potential measurement errors. Hence, an index (*FRQ_index*) consisting of three different methods of measuring financial reporting quality is employed.

The first method is performance matched discretionary accruals developed by Kothari et al. (2005). This study estimates the following regression model by year and for each industry, which includes at least 20 observations:

$$TAccr_{i,t} = \beta_0 + \beta_1\left(1/Assets_{i,t}\right) + \beta_2 \Delta Rev_{i,t} + \beta_3 PPE_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \quad (5.1)$$

where *TAccr* is the total accruals, measured as the difference of the annual change in non-cash current assets and the annual change in current non-interest-bearing liabilities, minus the depreciation and amortisation expense, scaled by the lagged total assets (*Assets*); *ΔRev* is the annual change in revenues scaled by lagged total assets; *PPE* is the property, plant, and equipment, scaled by lagged total assets; *ROA* is the return on assets, measured by the net profit over total assets. The discretionary accruals are the residuals from Equation (5.1). The absolute values of discretionary accruals (*DAC*) are utilised as a component of the FRQ index. Higher values of *DAC* lead to lower financial reporting quality.

The second method employed in this study is the Dechow and Dichev (2002) model, as improved by McNichols (2002) and Francis et al. (2005). The following regression model is cross-sectional estimated and there should be at least 20 observations for each year and industry:

$$TCAccr_{i,t} = \beta_0 + \beta_1 OCF_{i,t-1} + \beta_2 OCF_{i,t} + \beta_3 OCF_{i,t+1} + \beta_4 \Delta Rev_{i,t} + \beta_5 PPE_{i,t} + \varepsilon_{i,t} \quad (5.2)$$

where *TCAccr* is the total current accruals, measured as the difference between the annual change in non-cash current assets and the annual change in current non-interest-bearing liabilities, scaled by the lagged total assets; *OCF* is the lagged (year t-1), current (year t), and lead (year t+1) operating cash flow, scaled by the lagged total assets; *ΔRev* is the annual change in revenues scaled by lagged total assets; *PPE* is the property, plant, and equipment, scaled by lagged total assets. A firm's current accruals are determined by the cash flows from operations, the growth in revenues and the level of PPE, whilst the difference between the real and expected current accruals of a firm (the residuals in Equation (5.2)) represents the quality of accruals and earnings. The absolute residuals (*DD*) are employed as a component of the aggregate index for financial reporting quality (*FRQ_index*). Higher values of *DD* lead to lower financial reporting quality.

The third method is squared abnormal accruals, as proposed by Rajgopal and Venkatachalam (2011). This study estimates the following regression model for each industry with at least five observations in the specific year *t*:

$$TAccr_{i,t} = \beta_0 + \beta_1(\Delta Rev_{i,t} - \Delta AR_{i,t}) + \beta_2 PPE_{i,t} + \beta_3 ROA_{i,t} + \varepsilon_{i,t} \quad (5.3)$$

where *TAccr* is the total accruals, measured as the difference of the annual change in non-cash current assets and the annual change in current non-interest-bearing liabilities, minus the depreciation and amortisation expense, scaled by the lagged total assets; *ΔRev* is the annual change in revenues scaled by lagged total assets; *ΔAR* is the change in account receivable, scaled by lagged total assets; *PPE* is the property, plant, and equipment, scaled by lagged total assets; and *ROA* is the return on assets. The residuals of Equation (5.3) are the abnormal accruals and the squared term of abnormal accruals ($ABACC^2$) is the last component of the FRQ index. Higher values of $ABACC^2$ lead to lower financial reporting quality.

As discussed above, an aggregate score is employed to present the quality of a firm's financial reporting. Follow Biddle et al. (2009) and Chen et al. (2011a), the aggregate financial reporting quality index (*FRQ_index*) is derived from the average of normalised values of these three measures. Hence, this study can provide evidence based on an overall financial reporting metric.

(2) The supervisory board and financial reporting quality

This study investigates the relationship between the supervisory board and financial reporting quality among listed CEs. In accordance with the hypotheses developed in section 5.2, the main regression is constructed below with several control variables:

$$FRQ\_index_{i,t} = \beta_0 + \beta_1 Supervisory\_board_{i,t} + \beta_2 Boardsize_{i,t} + \beta_3 Independent\_directors_{i,t} + \beta_4 Ceo\_duality_{i,t} + \beta_5 Leverage_{i,t} + \beta_6 ROA_{i,t} + \beta_7 MB_{i,t} + \beta_8 Firmage_{i,t} + \beta_9 Firmsize_{i,t} + \beta_{10} Big4_{i,t} + \beta_{11} Listexg_{i,t} + fixed\ effect\ of\ indusry\ and\ year + \varepsilon_{i,t} \quad (5.4)$$

where *Supervisory_board* is denoted as a series of supervisory board related variables. Follow the developed hypotheses. These include the size, composition, characteristics, and incentive variables of the supervisory board. *Supervisory_size* is measured by the total number of members on the supervisory board. As most supervisory boards generally comprise shareholder and employee representatives, the proportion of supervisors from the central enterprise or its affiliations (*Affiliated_ratio*) and the proportion of employee representatives on the supervisory board (*Employee_ratio*) are employed to measure the composition of the supervisory board. For the characteristics of the supervisory board, *Age* is the average age of the supervisors on the board. *Age_diversity* is calculated as the standard deviation of the age of supervisors on the board scaled by the average age of the firm's supervisors (Ali et al., 2013). Gender diversity is measured, using the proportion of female supervisors on the board (*Female_ratio*). Last, the effect of board economic incentives is investigated, represented by the natural logarithm of the average total compensation of supervisors (*Compensation*).

In addition to the supervisory board related variables, other factors (i.e. corporate board characteristics, a firm's financial characteristics, and its specific characteristics) that may influence financial reporting quality are included in the regression model as well.

In the Chinese corporate governance system, the corporate board deals with a firm's decision-making and operational issues. To a varying extent, the board of directors is involved in making financial statements. Hence, the board of directors may influence the financial reporting quality of listed firms. Karamanou and Vafeas (2005) argue that having more directors on the corporate board enhances its knowledge base. However, the board with too many directors turns into being less flexible and less efficient. The authors also point out that the second effect seems to dominate the first, as Yermack (1996) reports that the corporate board in most listed firms has already been relatively large. This is consistent with the argument put forward by Jensen (1993) that larger boards are not as effective as smaller ones. Hence, this study controls for the potential effect of the size of the board of directors (*Boardsize*) and predicts that it has a negative effect of large boards on financial reporting quality.

Independent directors on the corporate board are another major monitoring mechanism in the Chinese corporate governance system. CSRC regulates that at least one of independent directors should have an accounting background. The independent directors with an accounting background are more confident in monitoring financial reporting quality. Hence, it is necessary to control for the potential effect of independent directors on financial reporting quality. The independent directors are measured as their proportion on the corporate board (*Independent_directors*). However, existing empirical evidence is mixed. For instance, Firth et al. (2007) find a positive effect of independent directors on constraining earnings management, whilst in contrast, Habbash et al. (2014) document that the independent directors fail to mitigate earnings management. Hence, the sign of *Independent_directors* is uncertain in this study.

CEO duality is another board characteristic that is widely discussed in the literature. *Ceo_duality* is, thus, an indicator variable that equals one if the chairman holds the position

of CEO at the same time and zero, otherwise. Donaldson and Davis (1991) suggest that the chairman of the corporate board also holding the position of CEO can improve the efficiency of a firm's decision-making. However, Brickley et al. (1997) argue a person with a lot of power has more ability to falsify the financial statements if he/she wants to do so. Hence, this study predicts there that CEO duality affects the informativeness of earnings.

In accordance with the existing literature, the potential effects of financial related variables are investigated. *Leverage* captures the impact of debt contracting on the informativeness of earnings, measured by total debt over total assets. *ROA* is the return on assets, widely adopted as the prime performance indicator. Wang and Wu (2011) document that firms with poor corporate profitability are more likely to have restatements of financial reporting. Firth et al. (2007) argue that listed firms with more growth opportunities may have incentives to engage in earnings management, as they require a lot of funding to support expansion. Hence, the main regression includes the firm's growth opportunities. In line with Firth et al. (2007), Balakrishnan et al. (2011), and Cao et al. (2012), this study uses the ratio of the market value to the book value of assets (*MB*) as the proxy for growth opportunities.

The last group of control variables relates to a firm's characteristics. Huang et al. (2012) argue that the number of years of a firm listing on the stock exchange (*Firmage*) is likely to be associated with the strength of its internal control system and consequently, affects its financial reporting quality. Beneish (1999) contends that the internal control system in younger firms is relatively weaker and may fall behind its development of business operations. Moreover, younger firms in the growth stage are prone to engage in earnings management because of their strong financing needs (Habbash et al., 2014). *Big4* is an indicator variable that equals one if the big four accounting companies provide the auditing service, and zero, otherwise. This variable can reflect the audit quality, for Frankel et al. (2002) suggest, auditors from the big four accounting companies are less likely to allow earnings management. The stock exchange that listed CEs come under is also distinguished. *Listexg* equals one, if the listed CEs are on the Shanghai Stock Exchange and equals zero, if on the Shenzhen Stock Exchange. The main regression (Equation (5.4)) controls for the fixed effect from the industry and year as well. As the listed CEs are concentrated in certain

industries, this study follows the *Guidance for Industry Classification of Listed Companies* (1999) released by the CSRC and divides the listed CEs into four industries: Utilities, Conglomerates, Industrials, and Commerce. Table 5-1 summarises the detailed definitions of the main variables employed in the main regression specification.

5.3.2 Data and sample selection

To examine the relationship between the supervisory board and financial reporting quality among listed CEs, this study collected related information of all listed CEs over the main research period from 2012 to 2016. In this study, the supervisors are defined as affiliated, if they concurrently have a position in the central enterprise or its affiliations.[50] This study manually collected the information about the affiliated supervisors from the central enterprise groups from the annual reports. The financial and other corporate governance related information was obtained from the Chinese Securities Market and Accounting Research (CSMAR) Database. This study excluded the listed CEs in the finance and real estate industries as well as observations with negative equity. A sample of 1,050 firm-years observations on 236 unique listed firms was obtained before conducting the main regressions. Sample size may vary due to the multiple calculation methods of the dependent variable.

Table 5-2 reports the summary statistics of the experimental variables before conducting the main regressions. For the supervisory board-related information, in listed CEs, it contains an average of five members, which just meets the regulation of the *State-owned Assets Law of The People's Republic of China* (2008). It requires that the supervisory board of SOEs (either solely-owned or simply controlled by the government) should have no fewer than five members. For board composition, 41.9% of supervisors come from the central enterprise or its affiliations, and 37.5% of supervisors are employees from listed CEs. Even though the listed firms are mandated to have at least one-third employee representatives on the supervisory board, some still fail to meet this requirement, as the minimum value of the employee representative ratio is 14.3%. The average age of supervisors on the board is around 49 years old, and the average diversity of each supervisory team is 0.12. It means that, in the average supervisory team, supervisors' ages span from 43 to 55 years old. The average proportion of female supervisors on the supervisory board is 20.8%. For the board of directors related information, on average, the listed CEs have ten members on the board,

[50] For instance, Sinopec Limited (a listed CE) is ultimately controlled by China Petrochemical Corporation Group (a CE). Sinopec Group has 71.32% ownership of its listed subsidiary. In 2016, two members on the supervisory board of Sinopec Limited concurrently have a position in Sinopec Group, therefore those two supervisors are named "affiliated supervisors". For the detailed information, please see Appendix 3.

and 37% of them are independent, which illustrates that most listed CEs follow the minimum requirement of one-third of corporate board members should be independent. Moreover, the majority of listed CEs has different chairmen and CEOs. For the financial related control variables, the listed CEs have an average leverage ratio of 53.4%, measured by total debt over total assets, 2.32% of return on total assets and 2.03 of market-to-book ratio. The average number of years since the listed CEs went public is 14 and their size varies from 0.31 to 2,405.27 billion RMB. *Listexg* shows that around 69% of the listed CEs are on the Shanghai Stock Exchange.

Table 5-3 provides Pearson correlations among the main variables employed in this study, which provides initial insights into the relationship between the supervisory board and financial reporting quality in listed CEs. As predicted, the size of the supervisory board is significantly negatively correlated with the FRQ index and the proportion of affiliated supervisors is significantly positively correlated with this index, which provides preliminary empirical evidence to support H1 and H2a. For the characteristics of the supervisory board, the average age is significantly negatively correlated with the FRQ index. In contrast, the age diversity of the supervisory team is significantly positively correlated with the index. These results support H3a and H3b, respectively. Last, the board incentive (the average compensation of supervisors) is significantly negatively correlated with the FRQ index, which is consistent with H4. Overall, most supervisory board related variables have significant influences on financial reporting quality. The more reliable results of multivariate tests, controlling for differences in industry or year characteristics, are reported in the next section. The correlation matrix also intuitively checks the presence of potential multicollinearity problem. In Table 5-3, the correlation coefficients among the main independent variables and control variables do not have an absolute value higher than 0.7, which could indicate there is no multicollinearity problem among the variables.

5.4 Empirical results

5.4.1 The impact of the supervisory board on financial reporting quality

Table 5-4 shows the empirical results examining the hypotheses developed before. Columns (1) to (8) report the results that test each hypothesis separately, and Column (9) shows the results for all hypotheses being examined together in one regression model.

Column (1) indicates whether the size of the supervisory board has effects on financial reporting quality. As shown in Column (1), the coefficient of *Supervisory_size* is negative and significant at the 10% level. Since a lower value of *FRQ_index* represents higher financial reporting quality, the negative coefficient of *Supervisory_size* indicates a positive relationship between the size of the supervisory board and financial reporting quality among listed CEs. This result supports H1, and is in line with a study conducted by Firth et al. (2007), which reported that the size of the supervisory board has a positive effect on improving financial reporting quality.

Column (2) and (3) report the effect of supervisory board composition on financial reporting quality. Board composition is measured through two aspects: the proportion of affiliated supervisors (*Affiliated_ratio*) and the proportion of employee representatives (*Employee_ratio*). In Column (2), the coefficient of *Affiliated_ratio* is 0.273, and it is significant at the level of 5%, indicating that more supervisors from the central enterprise or its affiliations weaken the financial reporting quality of listed CEs. This supports H2a that the affiliated supervisors from the central enterprises have a negative effect on the quality of accounting information among listed CEs. In Column (3), the coefficient of *Employee_ratio* is not significant, thus illustrating that employee representation on the board has no significant impact on financial reporting quality in listed CEs. This insignificant result supports H2b and is consistent with Ran et al. (2015), who also failed to find a positive effect of labour supervisors on improving financial reporting quality, with a sample of all Chinese non-financial listed firms from 1999 to 2012. The government has issued related regulations to enhance the function of employees. Such as, the aforementioned revised *Company Law*

(2005), which requires all listed firms to have at least one-third employee representatives on the supervisory board. However, the insignificant effect of employee representatives found in recent studies suggests that further regulations should be carried out by the government in order to guarantee the rights of employees and to make the employee representatives effective. In short, neither affiliated supervisors nor employee representatives can improve financial reporting quality in listed CEs. Hence, it is essential to identify a better structure for the supervisory board in listed CEs.

Columns (4) to (6) show whether the characteristics of the supervisory board affect financial reporting quality. To be specific, in Column (4), the coefficient of *Age* is -0.0279, which is significant at the level of 5%. This means that a supervisory team with older average age can improve financial reporting quality, as monitoring financial activities needs more experience. This linear result is consistent with Ran et al. (2015). Moreover, in Column (5), *Age_diversity* is significantly positively correlated with *FRQ_index* at the level of 10%. This shows that in listed CEs, the age diversity of the supervisory board brings negative effects to financial reporting quality. This suggests that supervisors on the board in listed CEs should be older and of a similar age, as the supervisory board can take advantage of their rich experience. Moreover, the supervisory board is more likely to get unanimous decisions. Subsequently, a more efficient supervisory board can promote financial reporting quality in listed CEs. Column (6) shows the potential effect of female supervisors. However, this study fails to find a significant linear relationship between female supervisors and financial reporting quality in listed CEs, as the coefficient of *Female_ratio* is insignificant.

Last but not least, the effect of board incentive is examined by using the average total compensation of supervisors. In Column (8), the coefficient of *Compensation* is negative, but not significant, which shows that the compensation of supervisors does not affect the financial reporting quality of listed CEs. This implies that the compensation package offered to the supervisors does not motivate them effectively and hence, will not lead to the improvement in financial reporting quality in listed CEs.

In case there are potential non-linear relations between the supervisory board related independent variables and financial reporting quality (*FRQ_index*), the quadratic term of each independent variable is added into the regression model separately. As only female supervisors and financial reporting quality have a curvilinear relationship, Table 5-4 does not report the insignificant non-linear relation results between other independent variables and financial reporting quality. Column (7) shows that there is a U-shaped relation between female supervisors and financial reporting quality, indicated by the positive coefficient of *Female_ratio* and the negative coefficient of *Female_square*, which are significant at the 5% and 10% level respectively. The turning point is 0.442 (0.647/(-(-0.731×2)), which means when the proportion of female supervisors exceeds 44.2%, this has a positive effect on improving financial reporting quality. However, before this point, the increase of female supervisors on the board weakens financial reporting quality. The result shows that the proportion of female supervisors should exceed 44.2%, for this will can improve the monitoring function of the supervisory board. However, most listed CEs still put up female supervisors as a minority. A plausible reason is that the listed CEs just want to deliver a positive signal to the public in order to conceal the potential earnings management behaviour better, rather than allowing for effective monitoring from the female supervisors. In this circumstance, not enough females on the supervisory board may lead to worse financial reporting quality. Also, transferring the turning point from the percentage to the number of female supervisors, it emerges that the turning point of female supervisors is three[51]. It means when there are three or more women on the supervisory board, this group becomes more powerful and has a positive effect on the improvement of financial reporting quality in listed CEs. Hence, this study provides new evidence on the critical mass theory (Kanter, 1977) and the magic number of three women (Kristie, 2011). Given Ran et al. (2015) document a positive linear relation between female supervisors and financial reporting quality for a full sample of Chinese non-financial listed firms, the U-shaped relationship between the two in listed CEs is a novel finding.

Regarding the control variables, *Firmsize* is significantly negatively related to *FRQ_index* in most of the regressions in Table 5-4. It shows that large listed CEs have better financial

[51] The average number of supervisors in listed CEs is five, which is shown in Table 5-1. Therefore, the turning point of female supervisors in units is derived from 5 × 0.442.

reporting quality, which is in line with the argument of Meek et al. (2007) that large firms are less likely to engage in earnings management. The other control variables are not significant.

5.4.2 Sensitivity tests

This subsection carries out several robustness tests in support of the analysis on the main regressions. First, this study repeats the main regressions with alternative measures of financial reporting quality, including components of the FRQ index: the DAC model, DD model, and ABACC^2 model. The detailed estimation of three methods pertains to Equations (5.1) to (5.3).

Panels A to C in Table 5-5 tabulate the empirical results of the regressions with the dependent variable estimated by DAC model, DD model and ABACC^2 model, respectively. In Table 5-5, it shows that the positive effect of supervisory board size is significant in all alternative measures of financial reporting quality, as indicated by the significant negative coefficient of *Supervisory_size* in all panels.

For the composition of the supervisory board, the coefficient of *Affiliated_ratio* in the regressions with the dependent variable estimated by these three different specifications is significant at least at the 10% level. Hence, H2a is valid, that more affiliated supervisors on the board weaken the financial reporting quality of listed CEs. However, all components of the financial reporting quality index fail to find significant evidence that employee representatives on the supervisory board affect financial reporting quality. Thus, H2b is accepted by all these three alternative methods and consequently, this study concludes that labour representation on the supervisory board does not affect financial reporting quality in listed CEs.

For the characteristics of the supervisory board, Columns (4) and (5) in Panels A to C show that the average age of the supervisory team is positively related to financial reporting quality, as indicated by the significant negative coefficient of *Age* in Table 5-5. Also, the

finding of the age diversity of the supervisory board that has a negative effect on financial reporting quality is valid for these three alternative methods of reporting it, as the coefficient of *Age_diverstiy* is significant at least at the level of 10% in all the panels of Table 5-5. Since the positive coefficient of *Female_ratio* and the negative coefficient of *Female_square* in Table 5-5 are significant at least the level of 10%, the U-shaped relation between female supervisors and financial reporting quality is robust. Moreover, the average turning point is 0.434, which is similar to that (0.442) found for the main regression with the dependent variable measured by the financial reporting quality index (*FRQ_index*). This study, thus, concludes that the proportion of female supervisors on the board has a U-shaped relationship with financial reporting quality in listed CEs, whereby the female supervisors show the ability to monitor effectively when they hold close to half the seats on the supervisory board.

Last, this study has failed to find significant evidence on the relationship between supervisor compensation and financial reporting quality among different measures of financial reporting quality. Hence, this study documents that the total average compensation of the supervisory board has no effect on financial reporting quality among listed CEs.

There may be an endogeneity issue between the supervisory board and financial reporting quality, as a firm's financial reporting quality can affect both the incentive of someone joining the board as a supervisor and the motivation of adding more qualified ones to the board. In order to address such a potential endogeneity problem caused by causality, this study replaces the contemporary independent variables with one-year lagged ones. This is because the function of the supervisory board may need time to reflect on a firm's financial reporting quality. Table 5-6 reports the empirical results with one-year lagged supervisory board related variables. They provide consistent outcomes with those of the main regressions reported in Table 5-4.

Furthermore, the strict exogeneity test suggested by Wooldridge (2010, p. 285) is employed to address the potential endogeneity issue again. The main regression includes the first order leading term *Supervisory_board* $_{t+1}$ as additional regressors. Under the null hypothesis

of strict exogeneity, the coefficient of *Supervisory_board*$_{t+1}$ would be equal to zero. It means that the independent variables (i.e. *Supervisory_board*) are strictly exogenous, as their first order leading terms are not associated with $\varepsilon_{i,t}$. Table 5-7 reports the empirical result. All leading variables related to the supervisory board are insignificant, which means that they are not endogenous to financial reporting quality. In sum, these tests show that the financial reporting quality of listed CEs does not lead to the observed supervisory board structure nor attract people with certain characteristics to be the supervisor.

5.5 Extended tests

Based on models discussed in section 5.3 and results reported in section 5.4, this study finds that the size of the supervisory board has a positive effect in improving the financial reporting quality of listed CEs. The composition of the supervisory board has a mixed relationship with financial reporting quality, whereby affiliated supervisors from the central enterprise groups weaken financial reporting quality, while employee representatives have no impact on it. Regarding the characteristics of the supervisory board, supervisors with older and similar ages can improve financial reporting quality. The relation between female representatives on the supervisory board and financial reporting quality is a U-shape with a critical mass point at 0.442 (turning point). Last, this study has failed to find that the board incentive (average compensation of supervisory board) works in improving financial reporting quality. This section carries out extended tests to examine the other factors that potentially affect the relationship between the supervisory board and financial reporting quality among listed CEs.

5.5.1 Extra control from the ultimate owner and the effect of the supervisory board on financial reporting quality

As noted, the listed CEs have a strong connection with the central government and are subject to more significant political influence. The Chinese government has conducted four rounds of mixed-ownership reforms that have brought non-state capital into SOEs, in order to make them more competitive in the capital market. Also, it has been separating its government function from enterprise management. However, the central government still exercises extra control power on some listed CEs by deviating the cash-flow rights from the voting rights through the pyramid structure. Claessens et al. (2002) document that the divergence of control and ownership from the ultimate controlling shareholders leads to lower firm value, as the willingness of the ultimate controlling shareholders to expropriate the wealth of minority shareholders is less restrained by their cash-flow rights. In this case, as the practical ultimate owner of listed CEs, the central enterprises may transfer resources from listed CEs to the other affiliations in the business group to fulfil the political and profit

targets set by the superior governmental institutions. Since these are tunnelling activities against the interest of minority shareholders and not accepted by the public, the listed CEs will seek to engage in earnings management to conceal them on the financial statement. Hence, the quality of financial reporting will deteriorate under this circumstance.

There is a further examination as to whether extra control from the central enterprises affects the monitoring function of the supervisory board on financial reporting quality in listed CEs. To be specific, this study tests the performance of two different types of supervisors (affiliated supervisors and employee representatives) on financial reporting quality under extra control from the central enterprises. For which, a dummy variable measures the presence of extra control from the central enterprises (*Extra_control*). It equals 1 if the voting rights exceed the cash-flow rights owned by the central government and 0, if the voting rights just equal the cash-flow rights owned by the central government. To examine the influence of extra control, this study adds the interaction term of *Extra_control* and *Affiliated_ratio* (*Employee_ratio*) into the main regression. As most studies (e.g., Claessens et al., 2002; Yeh, 2005; Chou et al., 2018) agree that the divergence of control and ownership leads to an entrenchment effect, this study expects that extra control from the central enterprises strengthens the negative effect of affiliated supervisors on financial reporting quality and weakens the potential effect of employee representatives on it.

Panel A, Table 5-8 displays the statistics of listed CEs with extra control from the central enterprises from 2012 to 2016. The average number of listed CEs with extra control from the central enterprises is 73, which is around 40%. That is about 40% of the observations experience extra control power from the central enterprises due to the deviation of cash-flow rights from voting rights.

Panel B, Table 5-8, shows the results from examining the influence of extra control by the central enterprises on the relationship between these two different types of supervisors and financial reporting quality. In Column (1), the coefficient of the interaction term of *Extra_control* and *Affiliated_ratio* is not significant. This means that extra control from the

central enterprises does not have a substantial influence on the relation between affiliated supervisors and financial reporting quality. In Column (2), the insignificant coefficient of the interaction term of *Extra_control* and *Employee_ratio* shows that extra control from the central enterprises does not have a significant influence on the relationship between employee representatives and financial reporting quality either. Overall, extra control from the central enterprises does not influence the relationship between these two types of supervisors and financial reporting quality among listed CEs.

5.5.2 The size effect and the effect of the supervisory board on financial reporting quality

In the main regressions, this study finds that large listed CEs have better financial reporting quality. This result is consistent with the evidence found by Lang and Lundholm (1993) that firm size is positively related to disclosure policy decisions. Cohen (2008) also documents that the larger the firm, the higher quality of its financial reporting, with a sample of 18,264 firm-year observations in a period from 1987 to 2003. There are several possible reasons why large firms are not likely to engage in earnings management. Meek et al. (2007) argue that firm size is a good proxy for information asymmetry and strength of governance. The existing literature (e.g., Collins et al., 1987; Haw and Kim, 1991) shows that large firms generally have lower information asymmetry, which effectively constrains the potential earnings management behaviours. Large firms are also found to experience strong internal and external monitoring. Kesner (1988) documents that larger firms have more reliable boards, as they have a larger proportion of independent directors. Also, such firms are generally the clients of large accounting companies with higher quality audits (DeAngelo, 1981). Meek et al. (2007) also argue that large firms are more in the public eye and the sanctions due to manipulating earnings are likely to be more severe for them than small ones. The larger listed CEs are important and usually concentrated in monopoly industries, which leads to more political sensitivity than with smaller firms and more scrutiny from the government. For instance, PetroChina Company Limited had around 2.4 trillion RMB assets in the period from 2012 to 2016 and, is one of the largest listed CEs. The information in such listed CEs (e.g. the appointment and removal of top executives) generally attracts more attention from the public. It is important for large listed CEs to make information transparent, in order to maintain their reputation.

Accordingly, whether the supervisors in large listed CEs have different performance on financial reporting quality is examined. A dummy variable is used to distinguish the large listed CEs (*Large_firm*size). It equals 1 if the firm size is over the average value of *Firmsize* in the sample and 0, otherwise. Then, this variable and its interaction term with *Affiliated_ratio* (*Employee_ratio*) are added to the main regression. As the large firms are generally discussed as having better informativeness of earnings, this study predicts that

large firm size can constrain the negative effect of affiliated supervisors and promotes the potential effect of employ representatives on the supervisory board.

Table 5-9 shows the empirical results. For affiliated supervisors, the coefficient of the interaction term of *Large_firmsize* and *Affiliated_ratio* is negative and significant at the level of 10%. It indicates that large firms can mitigate the negative effect of affiliated supervisors on financial reporting quality in listed CEs. For employee representatives on the supervisory board, the coefficient of *Employee_ratio* and its interaction term with *Large_firmsize* fails to be significant, which shows that firm size does not have a significant influence on the relationship between employee representatives and financial reporting quality. Also, the median of firm size is utilised as the cut-off point to distinguish the large listed CEs, and this study obtains similar results.

5.6 Discussion

This study has involved investigating the effect of the supervisory board on financial reporting quality among listed CEs. Different to existing studies that argue the supervisory board in most Chinese listed firms are ineffective, this study does provide some empirical evidence on the positive function of supervisory boards in listed CEs. For instance, this study finds that a large supervisory board has a positive effect on improving the quality of financial information in listed CEs. Moreover, a supervisory board with older members is significantly positively related to the financial reporting quality of listed CEs, being explained as older supervisors having more experience and hence, they can play a better role in monitoring and dealing with financial affairs in listed CEs. Also, this study reports a U-shaped relation between the proportion of female supervisors and financial reporting quality. That is when there are three or more women on the supervisory board, the monitoring role of female supervisors becomes effective in improving financial reporting quality in listed CEs. Hence, this work provides new empirical evidence on the critical mass theory (Kanter, 1977) and the magic number of three women on the board (Kristie, 2011).

Also, this study identifies some characteristics of the supervisory board in listed CEs that bring adverse effects on financial reporting quality. The affiliated supervisors from the central enterprises weaken the informativeness of earnings in listed CEs, since the target of the central enterprise groups is politically oriented instead of profit oriented. The age diversity of the supervisory team has a significant negative effect on financial reporting quality as well. Lastly, this study finds that the employee representatives on the supervisory board and board incentives (average compensation of supervisors) have no relation with financial reporting quality in listed CEs.

In addition, this study has conducted extended tests in relation to this topic. First, this study examines whether extra control from the central enterprises affects the performance of two different kinds of supervisors on financial reporting quality. No significant evidence was found that extra control from the central enterprises affects the relationship between the affiliated supervisors (employee representatives) and financial reporting quality. Second,

this study tests whether firm size affects the performance of the affiliated supervisors and employee representatives on financial reporting quality. It emerges that listed CEs with a large size can mitigate the negative effect of affiliated supervisors on financial reporting quality, while this does not influence the relation between employee representatives and financial reporting quality in listed CEs.

The empirical results of this study provide political implications for regulators. The rights of employees should be further enhanced, as the employee representatives on the supervisory board are ineffective. Additionally, the supervisory board should be balanced with representatives from different interest groups. In particular, the government should limit the proportion of affiliated supervisors from the central enterprises and recommend the listed CEs to have more independent supervisors. Furthermore, the outcomes of this study suggest that listed CEs should have close to half female members on the supervisory board. Overall, the findings confirm that the presence of certain characteristics of the supervisory board in listed CEs can lead to the improvement of financial reporting quality. Having identified these characteristics, this sheds light on the appropriate future direction of the supervisory board reform in listed CEs and in fact, in all listed firms on the Chinese capital market.

Table 5-1 Summary of variable definitions

	Variables	Variable description
FRQ variable	DAC	The absolute residual values from the performance matched discretionary accruals model, referring to Equation (5.1).
	DD	The absolute residual values from the Dechow and Dichev (2002) model measuring the earnings quality, referring to Equation (5.2).
	$ABACC^2$	The absolute residual values from the squared abnormal accruals model, referring to Equation (5.3).
	FRQ_index	The average of the normalised values of the DAC, DD, and $ABACC^2$ models.
Supervisory board variables	Supervisory_size	Total number of supervisors.
	Affiliated_ratio	The ratio of supervisors affiliated with the central enterprise or its affiliations to the total number of supervisors.
	Employee_ratio	The ratio of employee representatives on the supervisory board to the total number of supervisors.
	Age	The average of the supervisory board team.
	Age_diversity	The standard deviation of age of the supervisors on the board scaled by the average age of the firm's supervisors.
	Female_ratio	The ratio of female supervisors to the total number of supervisors.
	Compensation	The natural logarithm of the average total compensation of supervisors.
Corporate board variables	Boardsize	Total number of directors on the corporate board.
	Independent_directors	The ratio of independent directors to the total number of directors on the board.
	Ceo_duality	A dummy variable that equals 1, if the CEO also holds the position of chairman of the board and equals 0, otherwise.
Firm characteristics variables	Leverage	The ratio of total debt to total assets.
	ROA	Return on assets; the ratio of net income to the total value of assets.
	MB	The ratio of the market value to the book value of assets.
	Firmage	The number of years since the listed CE went on public.
	Firmsize	The natural logarithm of total assets.
	Big4	An indicator variable that equals one, if the auditing service is provided by the big four accounting companies and zero, otherwise.

This table shows the definitions of the variables employed in the main regressions. The data on affiliated supervisors is manually collected from the annual reports of listed CEs, whilst other governance, ownership and accounting variables are gathered from CSMAR.

Table 5-2 Descriptive statistics of variables

Variable	Obs	Mean	Std	Min	Median	Max
Financial reporting quality						
DAC	952	0.0657	0.0703	0.0000266	0.0478	0.739
DD	940	0.0559	0.0526	0.00017	0.0412	0.295
$ABACC^2$	1044	0.00866	0.0284	3.6×10^{-11}	0.00197	0.594
FRQ_index	905	-0.0245	0.757	-0.746	-0.243	6.679
Supervisory board						
Supervisory_size	1050	4.245	1.422	2	4	12
Affiliated_ratio	1050	0.419	0.238	0	0.4	1
Employee_ratio	1026	0.375	0.0890	0.143	0.333	1
Age	1050	49.455	3.757	37.667	49.6	61
Age_diversity	1050	0.121	0.0506	0.00973	0.117	0.295
Female_ratio	1050	0.208	0.222	0	0.2	1
Compensation (10K/RMB)	1047	18.640	15.685	0	14.675	168.921
Board of directors						
Boardsize	1050	9.361905	1.926801	5	9	16
Independent_directors	1050	0.370	0.0596	0.231	0.333	0.714
Ceo_duality	1050	0.06	0.238	0	0	1
Financial performance						
Leverage	1050	0.534	0.197	0.0188	0.549	0.979
ROA	1050	0.0232	0.0593	-0.586	0.0245	0.298
MB	1050	2.026	1.268	0.219	1.599	9.707
Firm characteristics						
Firmage	1050	14.237	4.709	0	15	24
Firmsize (billion/RMB)	1050	52.592	199.419	0.307	8.195	2405.265
Big4	1050	0.167	0.373	0	0	1
Listexg	1050	0.692	0.462	0	1	1

This table reports the descriptive statistics of the main variables for the years 2012 to 2016.

Table 5-3 Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	FRQ_index	1																	
2	Supervisory_size	-0.096***	1																
3	Affiliated_ratio	0.076**	-0.171***	1															
4	Employee_ratio	-0.006	0.143***	-0.162***	1														
5	Age	-0.168***	0.097***	-0.050	0.026	1													
6	Age_diversity	0.088***	-0.012	0.0133	0.015	-0.366***	1												
7	Female_ratio	0.083**	-0.145***	0.0216	0.010	-0.263***	0.074**	1											
8	Compensation	-0.058*	0.149***	-0.156***	0.086***	0.066**	-0.060*	-0.051	1										
9	Boardsize	-0.070**	0.372***	-0.066**	-0.026	0.107***	-0.023	-0.099***	0.059*	1									
10	Independent_directors	0.016	-0.105***	0.009	0.105***	0.024	-0.038	0.008	-0.009	-0.322***	1								
11	Ceo_duality	0.035	-0.023	-0.046	-0.002	-0.064**	-0.020	-0.036	-0.006	-0.091***	0.137***	1							
12	Leverage	-0.096***	0.022	0.024	-0.006	0.061*	-0.012	-0.116***	0.028	0.174***	-0.003	0.015	1						
13	ROA	0.077**	-0.099***	-0.024	-0.086***	-0.177***	0.111***	0.143***	-0.113***	-0.165***	-0.061**	-0.036	-0.409***	1					
14	MB	-0.029	0.054*	-0.024	0.007	-0.031	0.013	0.071**	0.033	-0.003	-0.067**	-0.042	-0.314***	0.086***	1				
15	Firmage	0.062*	-0.119***	0.072**	0.060*	-0.048	0.012	0.026	-0.029	-0.141***	-0.117***	-0.023	-0.011	0.118***	-0.032	1			
16	Firmsize	-0.153***	0.270***	0.079**	0.013	0.378***	-0.176***	-0.149***	0.191***	0.306***	0.129***	-0.073**	0.415***	-0.566***	0.011	-0.182***	1		
17	Big4	-0.090***	0.101***	0.002	-0.008	0.157***	-0.159***	-0.041	0.116***	0.126***	0.069**	-0.005	-0.004	-0.196***	0.129***	-0.110***	0.459***	1	
18	Listexg	-0.084**	0.096***	0.010	-0.065**	0.082***	-0.028	-0.037	-0.036	0.172***	-0.045	-0.032	0.051*	0.011	-0.001	-0.395***	0.152***	0.077**	1
	N	1,050																	

This table reports the Pearson correlation matrix among the independent and control variables employed in the study. The description of variables refers to Table 5-1.
* p<0.10, ** p<0.05, *** p<0.01

Table 5-4 The effect of the supervisory board on financial reporting quality (FRQ_index)

	Dependent variable (FRQ_index)								
	Board Size	Board Composition		Board Characteristics				Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Supervisory_size	-0.031*								-0.023
	(0.018)								(0.017)
Affiliated_ratio		0.273**							0.146
		(0.127)							(0.117)
Employee_ratio			-0.135						0.028
			(0.238)						(0.244)
Age				-0.028**					-0.020*
				(0.011)					(0.011)
Age_diversity					1.071*				0.626
					(0.546)				(0.559)
Female_ratio						0.183	0.647**		0.443
						(0.123)	(0.286)		(0.272)
Female_square							-0.731*		-0.681*
							(0.377)		(0.360)
Compensation								-0.016	-0.010
								(0.019)	(0.023)
Boardsize	0.009	0.004	-0.002	-0.000342	0.000517	0.003	0.001	0.003	0.005
	(0.015)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Independent_directors	0.252	0.320	0.276	0.165	0.269	0.268	0.306	0.206	0.166
	(0.437)	(0.434)	(0.438)	(0.448)	(0.430)	(0.438)	(0.433)	(0.430)	(0.427)
Ceo_duality	0.068	0.069	0.0577	0.054	0.071	0.071	0.057	0.072	0.057
	(0.097)	(0.098)	(0.100)	(0.097)	(0.102)	(0.100)	(0.105)	(0.097)	(0.105)
Leverage	-0.286	-0.237	-0.164	-0.321	-0.261	-0.244	-0.246	-0.242	-0.225
	(0.212)	(0.207)	(0.211)	(0.213)	(0.208)	(0.209)	(0.211)	(0.207)	(0.212)
ROA	-0.561	-0.490	-0.423	-0.759	-0.634	-0.612	-0.679	-0.624	-0.624
	(0.492)	(0.486)	(0.499)	(0.505)	(0.502)	(0.495)	(0.499)	(0.493)	(0.507)
MB	-0.006	-0.013	-0.009	-0.006	-0.009	-0.011	-0.011	-0.011	-0.008
	(0.0297)	(0.031)	(0.031)	(0.029)	(0.030)	(0.030)	(0.030)	(0.030)	(0.031)

Firmage	0.000728	-0.000471	-0.002	0.002	0.001	0.001	0.002	0.000964	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Firmsize	-0.050*	-0.068**	-0.062**	-0.029	-0.055*	-0.056**	-0.054*	-0.055**	-0.033
	(0.029)	(0.030)	(0.029)	(0.029)	(0.028)	(0.028)	(0.029)	(0.028)	(0.032)
Big4	-0.063	-0.046	-0.047	-0.069	-0.042	-0.060	-0.067	-0.083	-0.066
	(0.073)	(0.074)	(0.073)	(0.073)	(0.073)	(0.073)	(0.074)	(0.067)	(0.070)
Listexg	-0.102	-0.109	-0.114	-0.092	-0.103	-0.100	-0.093	-0.116	-0.115
	(0.081)	(0.083)	(0.083)	(0.080)	(0.080)	(0.081)	(0.080)	(0.081)	(0.080)
Constant	0.419	0.271	0.454	1.677**	0.227	0.301	0.256	0.550	1.325*
	(0.357)	(0.335)	(0.378)	(0.717)	(0.334)	(0.342)	(0.341)	(0.383)	(0.725)
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	905	905	886	905	905	905	905	902	883
Adjusted R-squared	0.026	0.030	0.022	0.039	0.028	0.026	0.029	0.027	0.039
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

The table reports the OLS regression results absorbing the multiple fixed effects from industry and year. *Female_square* is the quadratic term of the proportion of female supervisors on the board. The description of variables refers to Table 5-1.
The standard errors are clustered by firm and shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5-5 Financial reporting quality measured by DAC model/DD model/ABACC[2] model

Panel A: Financial reporting quality measured by the DAC model

	Dependent variable (DAC)							
	Board size	Board Composition		Board Characteristics			Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisory_size	-0.003*							-0.003
	(0.002)							(0.002)
Affiliated_ratio		0.024**						0.012
		(0.011)						(0.010)
Employee_ratio			-0.001					0.016
			(0.019)					(0.019)
Age				-0.003***				-0.002**
				(0.001)				(0.001)
Age_diversity					0.079*			0.041
					(0.045)			(0.044)
Female_ratio						0.055**		0.037
						(0.023)		(0.023)
Female_square						-0.052*		-0.050
						(0.031)		(0.030)
Compensation							-0.002	-0.002
							(0.002)	(0.002)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	952	952	928	952	952	952	949	925
Adjusted R-squared	0.020	0.023	0.017	0.033	0.020	0.023	0.020	0.034
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Panel B: Financial reporting quality measured by the DD model

	Dependent variable (DD)							
	Board size	Board Composition		Board Characteristics			Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisory_size	-0.002*							-0.002
	(0.001)							(0.001)
Affiliated_ratio		0.015*						0.008
		(0.008)						(0.008)
Employee_ratio			-0.021					-0.013
			(0.020)					(0.021)
Age				-0.001**				-0.001
				(0.000595)				(0.000658)
Age_diversity					0.074*			0.048
					(0.042)			(0.045)
Female_ratio						0.039*		0.026
						(0.021)		(0.020)
Female_square						-0.053**		-0.049*
						(0.027)		(0.026)
Compensation							-0.000386	0.000207
							(0.001)	(0.001)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	940	940	921	940	940	940	937	918
Adjusted R-squared	0.047	0.049	0.044	0.054	0.049	0.048	0.047	0.053
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Panel C: Financial reporting quality measured by the ABACC[2] model

	Dependent variable (ABACC[2])							
	Board size	Board Composition		Board Characteristics			Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisory_size	-0.001**							-0.001*
	(0.000648)							(0.0006)
Affiliated_ratio		0.012***						0.008**
		(0.004)						(0.004)
Employee_ratio			-0.008					-0.001
			(0.006)					(0.005)
Age				-0.000673**				-0.000416
				(0.000317)				(0.000331)
Age_diversity					0.036**			0.0279*
					(0.015)			(0.015)
Female_ratio						0.018**		0.015*
						(0.008)		(0.008)
Female_square						-0.022**		-0.024**
						(0.010)		(0.011)
Compensation							-0.000530	-0.000310
							(0.000587)	(0.000705)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,044	1,044	1,020	1,044	1,044	1,044	1,041	1,017
Adjusted R-squared	0.014	0.018	0.011	0.016	0.013	0.012	0.012	0.023
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Panels A, B, and C display the results of the main regressions with alternative dependent variable measurements. DAC in Panel A is derived from the performance matched discretionary accruals model, which refers to Equation (5.1). DD in Panel B is calculated from the Dechow and Dichev (2002) model, referring to Equation (5.2). In Panel C, ABACC[2] is from the square abnormal accruals, which refers to Equation (5.3). The description of other variables refers to Table 5-1. The standard errors are clustered by firm and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5-6 Replacement of the independent variables with lagged supervisory board variables

	Dependent variable (FRQ_index)							
	Board size	Board Composition		Board Characteristics			Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisory_size	-0.037*							-0.038*
	(0.021)							(0.021)
Affiliated_ratio		0.076						-0.030
		(0.126)						(0.119)
Employee_ratio			-0.181					-0.059
			(0.374)					(0.378)
Age				-0.020				-0.016
				(0.012)				(0.012)
Age_diversity					1.464*			1.342*
					(0.753)			(0.698)
Female_ratio						0.564*		0.466
						(0.314)		(0.306)
Female_square						-0.670*		-0.633*
						(0.389)		(0.379)
Compensation							-0.007	-0.004
							(0.013)	(0.014)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	712	712	694	712	712	712	710	692
Adjusted R-squared	0.052	0.048	0.046	0.056	0.057	0.053	0.048	0.071
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

The table reports the OLS results when replacing the independent variables with one-year lagged data. *Supervisory_size* is lagged number of supervisors on the board. *Affiliated_ratio* is lagged affiliated supervisor ratio. *Employee_ratio* is lagged proportion of employee representatives on the supervisory board. *Age* is lagged average age of the supervisory board. *Age_diversity* is lagged age diversity of the supervisory board. *Female_ratio* is lagged female supervisor ratio. *Female_square* is the quadratic term of lagged female supervisor ratio. *Compensation* is lagged average total compensation of the supervisory board. The description of other variables is that of those shown in Table 5-1. The standard errors are clustered by firm and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5-7 The strict exogeneity test for supervisory board variables

	Dependent variable (FRQ_index)							
	Board size	Board Composition		Board Characteristics			Board Incentives	All
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Supervisory_size $_{t+1}$	-0.024							-0.035
	(0.036)							(0.040)
Affiliated_ratio $_{t+1}$		0.071						-0.028
		(0.148)						(0.147)
Employee_ratio $_{t+1}$			0.405					0.667
			(0.362)					(0.403)
Age $_{t+1}$				-0.014				-0.016
				(0.022)				(0.022)
Age_diversity $_{t+1}$					-1.408			-1.706
					(1.266)			(1.299)
Female_ratio $_{t+1}$						-0.011		-0.075
						(0.543)		(0.525)
Female_square $_{t+1}$						0.097		-0.376
						(0.668)		(0.618)
Compensation $_{t+1}$							-0.010	0.008
							(0.023)	(0.013)
Supervisory_size	-0.007							0.010
	(0.038)							(0.041)
Affiliated_ratio		0.339**						0.300**
		(0.140)						(0.134)
Employee_ratio			-0.461					-0.440
			(0.322)					(0.347)
Age				-0.024				-0.017
				(0.021)				(0.020)
Age_diversity					1.993			1.603
					(1.228)			(1.093)
Female_ratio						0.420		0.299
						(0.536)		(0.525)

Female_square						-0.553		-0.185
						(0.614)		(0.589)
Compensation							0.001	0.007
							(0.009)	(0.011)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	726	726	702	726	726	726	722	698
Adjusted R-squared	0.045	0.057	0.043	0.070	0.049	0.045	0.046	0.087
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

The table reports the OLS results of strict exogeneity tests. *Supervisory_size* $_{t+1}$ is the number of supervisors on the board in year t+1. *Affiliated_ratio* $_{t+1}$ is the affiliated supervisor ratio in year t+1. *Employee_ratio* $_{t+1}$ is the proportion of employee representatives on the supervisory board in year t+1. *Age* $_{t+1}$ is the average age of the supervisory board in year t+1. *Age_diversity* $_{t+1}$ is the age diversity of the supervisory board in year t+1. *Female_ratio* $_{t+1}$ is the female supervisor ratio in year t+1. *Female_square* $_{t+1}$ is the quadratic term of female supervisor ratio in year t+1. *Compensation* $_{t+1}$ is the average total compensation of the supervisory board in year t+1.
For the description of the other variables, please refer to Table 5-1.
The standard errors are clustered by firm and shown in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5-8 Extra control by the ultimate owner and the effect of supervisors on financial reporting quality

Panel A: Summary statistics of extra control from the ultimate owner in years

Year	2012	2013	2014	2015	2016	Total
Listed CEs with extra control (N)	77	75	75	76	63	366
Total listed CEs in years (N)	191	193	187	180	154	905
Listed CEs with extra control (%)	40.3%	38.9%	40.1%	42.2%	40.9%	40.4%

Panel B: Extra control from the ultimate owner and the effect of supervisors on financial reporting quality

	Dependent variable (FRQ_index)	
	Affiliated supervisors	employee representatives
VARIABLES	(1)	(2)
Affiliated_ratio	0.333*	
	(0.177)	
Affiliated_ ratio × Extra_control	-0.145	
	(0.251)	
Employee_ratio		-0.196
		(0.325)
Employee_ratio × Extra_control		0.155
		(0.427)
Extra_control	0.052	-0.067
	(0.099)	(0.184)
Control variables	YES	YES
Industry FE	YES	YES
Year FE	YES	YES
Observations	905	886
Adjusted R-squared	0.028	0.019
Cluster	Firm	Firm

Panel A reports the statistics of extra control from the ultimate owner in years.

Panel B reports the OLS regression results of the effect of supervisors on financial reporting quality under extra control from the ultimate owner. *Extra_control* is an indicator variable of the presence of extra control from the central enterprises. When the voting rights exceed the cash-flow rights owned by the central government, *Extra_control* takes 1 and 0, otherwise. The regression model has the same control variables with the main one, and the description of the variables is that of those shown in Table 5-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 5-9 Large listed CEs and the effect of supervisors on financial reporting quality

	Dependent variable (FRQ_index)	
	Affiliated supervisors	employee representatives
VARIABLES	(1)	(2)
Affiliated_ratio	0.471**	
	(0.220)	
Affiliated_ ratio × Large_firmsize	-0.441*	
	(0.253)	
Employee_ratio		-0.144
		(0.305)
Employee_ratio × Large_firmsize		0.065
		(0.479)
Large_firmsize	0.109	-0.101
	(0.114)	(0.204)
Control variables	YES	YES
Industry FE	YES	YES
Year FE	YES	YES
Observations	905	886
Adjusted R-squared	0.028	0.016
Cluster	Firm	Firm

The table reports the OLS regression results of size effect and the effect of supervisors on financial reporting quality.

Large_firmsize is an indicator variable that equals 1, if the firm size exceeds the mean and 0, otherwise. The regression model has the same control variables with the main one, and the description of the variables is that of those shown in Table 5-1.

The standard errors are clustered by firm and shown in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Chapter 6 Summary, Conclusions and Recommendations

6.1 Introduction

The main objective of this thesis was to examine the effectiveness of corporate governance mechanisms in listed CEs. This thesis carried out three independent studies relating to this topic. The first was set out to identify the determinants of affiliated directors from the central enterprise or its affiliations and to examine their effects on firm value. The second study discussed the relationship between independent directors and investment efficiency. The third study examined the impact of the supervisory board on improving firm's financial reporting quality.

The remainder of the chapter is as follows. Section 6.2 summarises and concludes the results for the three main studies. Section 6.3 highlights the implications of the research results. Section 6.4 discusses the limitations of this research. The suggestions for further research are shown in Section 6.5.

6.2 Summary of the results

6.2.1 Determinants of affiliated directors and their economic effects on firm value

This study first, investigated whether the cash-flow rights and the deviation of voting rights and cash-flow rights motivate central enterprises (on behalf of the central government) to appoint more affiliated directors onto the corporate board of listed CEs. The empirical results show that the high cash-flow rights owned by the central government have no relation with the appointment of affiliated directors. Yet the significant divergence of voting and cash-flow rights motivates the central enterprises to place more affiliated directors on the corporate board to enhance their control power on listed CEs.

Then, this study examined the effect of affiliated directors from the central enterprises on the firm value of listed CEs. It has been elicited that the affiliated directors from the central enterprises have an inverse U-shaped relationship with subsequent firm value. This implies that there is a balanced board structure (measured by the proportion of affiliated directors from the central enterprises), which leads to the highest firm value. This means that a moderate proportion of affiliated directors increases firm value. However, they reduce the firm value, when the representatives from the central enterprises on the corporate board exceed the turning point. Combining the main results found in this study that a higher entrenchment effect from the central enterprises leads to more affiliated directors on the corporate board, and that too many can reduce the firm value of listed CEs, this study finds that the corporate board is a main channel for the ultimate owner to enhance control power.

The results of additional tests show that the external audit is an effective external mechanism that can constrain the negative effect of too many affiliated directors on the corporate board, while foreign institutional investors are not an effective mechanism. Excess board seats control was employed as the proxy for the divergence of control and ownership, with the results showing that, excess board seats control from the central enterprises is harmful to the firm value of listed CEs. Additionally, this study finds that both the external audit and the foreign institutional shareholdings can eliminate the negative effect of excess board seats control from the central enterprises on firm value.

6.2.2 Independent directors and investment efficiency

Secondly, it has been elicited that the relationship between the proportion of independent directors and investment efficiency in listed CEs is non-linear. The turning point of the proportion of such directors is 47.3%. This suggests that before reaching this point, independent directors are negatively associated with investment efficiency. However, when more than this proportion are independent, then they have a positive effect on improving investment efficiency in listed CEs. Also, the U-shaped relationship between independent directors and investment efficiency is quite distinct among listed CEs through the PSM

approach. After separating the full sample into the over- and under-investment groups, this study finds a consistent result in the over-investment group, but no significant evidence among firms with insufficient investment issues emerged. The evidence shows that the independent directors can improve investment efficiency in listed CEs, when their proportion exceeds a certain level, and this evidence is more prominent in over-investment firms.

In addition, this study examined the attendance behaviour of independent directors measured by the average frequency of independent directors appointing a representative to attend board meetings. The empirical result shows that high frequency of independent directors delegating a representative to attend meetings leads to lower investment efficiency in listed CEs. Also, this evidence is valid in both the over- and under-investment groups. Moreover, more female independent directors on the corporate board improve investment efficiency in the full sample as well as the over-investment group. This study only finds a significant positive relationship between the age diversity of independent directors and investment efficiency in the over-investment group. Last, it has been documented that extra control from the central enterprises hinders the function of independent directors, with a similar result emerging in the over-investment group, but not the under-investment one.

6.2.3 The supervisory board and financial reporting quality

Study 3 examined the relationship between the supervisory board and financial reporting quality according to four aspects: supervisory board size, board composition, board characteristics, and board incentives. It has been found that a large supervisory board improves the financial reporting quality of listed CEs. The effects of supervisory board composition on the informativeness of earnings are mixed. The proportion of affiliated supervisors from the central enterprises is negatively associated with financial reporting quality. In contrast, the proportion of employee representatives has no effect on financial reporting quality in listed CEs. Regarding the characteristics of the supervisory board, it emerged that a supervisory team of older and/or similar age has a positive impact on the

financial reporting quality of listed CEs. The gender diversity of the supervisory board measured by the proportion of female supervisors has a U-shaped relation, with financial reporting quality with a turning point of three in number. When there are more than three female supervisors on the supervisory board, the supervisory board becomes effective in improving the financial reporting quality of listed CEs.

This study also conducted two extended tests. These involved examining whether extra control from the central enterprises and firm size affect the performance of affiliated supervisors and employee representatives on the supervisory board. The results show that extra control from the central enterprises does not affect the relationship between these two kinds of supervisors and financial reporting quality. Also, large firm size can mitigate the negative effect of affiliated supervisors on financial reporting quality but does not influence the relationship between employee representatives and financial reporting quality.

6.3 Implications of the results

The findings from the three studies suggest that modern corporate governance mechanisms do bring positive effects to listed CEs, which confirms the achievements of the central enterprise reform. For instance, Study 2 posits that independent directors improve investment efficiency in listed CEs, when they constitute more than 47.3% of directors on the corporate board. This relation is more evident among listed CEs with over-investment issues. Study 3 documents that larger and more independent supervisory board enhances the financial reporting quality of listed CEs. However, through this thesis, the deficiencies of the current corporate governance mechanisms in listed CEs have been identified as well, thus showing the direction for further central enterprise reform. A significant corporate governance problem uncovered in this research is in about the board members from the central enterprises. Specifically, it has been that too many representatives from the central enterprises on both the corporate board and the supervisory board have a negative effect on listed CEs. It provides the central government robust evidence on how to manage listed CEs in an appropriate way, which will involve further separating its role as the owner of state-owned assets and the regulator.

The reliable empirical evidence from this thesis provides political implications for the direction of the central enterprise reform aimed at idealising the modern enterprise system among listed CEs. The outcomes of this research suggest that the corporate board of listed CEs should have more than half of independent directors as members to make them more influential and powerful. Also, the corporate board in listed CEs should limit the proportion of affiliated directors from the central enterprises, which mitigates the potential entrenchment effect exerted by these central enterprises. It is informed that the balanced combination of the board structure of affiliated directors and independent directors can enhance the firm value of listed CEs. Similar to the corporate board, the supervisory board in listed CEs should control the proportion of supervisors affiliated with the central enterprises as well. Additionally, the government should amend related regulations to enhance the rights and the function of employee representatives on the supervisory board.

6.4 Limitations of the study

China is not the only economy that has SOEs, so the single country-specific analysis leads to limitations. As the concentrated ownership structure and government intervention are also common in other emerging markets, the findings in this thesis may provide the basis for the comparative research including this market. Also, the implications identified in this research for the central enterprises may not be suitable for other types of listed firms on the capital market, even though they share some similarities with these enterprises.

The proxy variable issue is a common problem to all empirical studies, which causes another limitation in this thesis. Those employed in this work have been theoretically and empirically defended, with alternative proxies being used as robustness checks. However, measurement error between the proxies and the theoretical propositions cannot be avoided, and the proxies may not accurately present the theoretical propositions.

6.5 Suggestions for further research

The One Belt One Road (OBOR) initiative[52] encourages Chinese enterprises to go abroad and promotes their overseas expansion with a range of new supporting government policies. Du and Zhang (2018) argue that SOEs are a strong force to fulfil political goals. Hence, the outward direct investment of listed CEs is an attractive topic for further study. The analysis between the corporate governance mechanisms and the outward direct investment of listed CEs could provide new insights into the effectiveness of the corporate board in alternative investment decision-making among listed CEs.

Another natural extension of this research would be to investigate further the characteristics of these affiliated directors, such as the educational background, work experience, gender diversity, early-life career and age. This would reveal what kind of affiliated members are usually chosen by the central enterprises. Whether the characteristics of affiliated directors have a more significant impact on the firm value or other indicators of a firm's corporate governance level is another potential research avenue. A clear understanding of the characteristics of affiliated directors can further inform the governance reform and provide more precise regulation recommendations.

Whilst this study focuses on listed CEs, it is also meaningful to investigate such corporate governance related issues among listed local SOEs (the listed firms ultimately controlled by local governments). Hence, the subsequent research should extend this governance topic to listed local SOEs and ascertain whether the central and local governments have different motivations, thus leading to different phenomena in these two kinds of listed SOEs. Such comparative research could provide more specific implications for the reform of both listed CEs and listed local SOEs.

[52] The initiative is a grand plan for China's economic integration with various parts of the world (particularly the countries located on the Silk Economic Belt and New Maritime Silk Road, such as Central and West Asia, Western Europe and Russia). This initiative encourages Chinese enterprises to increase their direct overseas investments in various sectors in related countries. In particular, China mainly integrates the trading partners by developing their infrastructure in order to implement Beijing's own interests. Most infrastructure projects are undertaken by SOEs (Du and Zhang, 2018).

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Appendix

1. List of Guiding lines of SOE Reform since the Third Plenary Session of the 18th CPC National Congress

("1+N" System)

Document Type	Classification	Document Name	Time of Promulgation
"1"	General requirements	*Guidelines of the CPC Central Committee and the State Council on Deepening SOE Reform*	September 2015
"N"	Classified SOE reform	*Guidelines on the Definition and the Classification of SOE Functions*	December 2015
		Implementation Plan for Improving Functional Classified Assessment of Central SOEs	September 2016
	Mixed ownership economy	*Opinions on the Development of Mixed Ownership Economy for SOEs*	September 2015
		Guidelines on Encouraging and Standardizing SOE Investment Projects and Introducing Non-state Capital	September 2015
		Opinions on State-controlled Mixed Ownership Enterprises' Implementation of the Pilot Employee Stock Ownership Program	August 2016
	Modern enterprise system	*Guidelines of the State Council General Office on Further Improving the Legal Person Governance Structure of SOEs*	April 2017
		Opinions on Conducting the Pilot Program of Market-oriented Recruitment and Management of SOEs Managers	December 2016
		Opinions on Reforming Compensation System for Central SOE Executives	November 2014
		Opinions on the Reasonable Determination and Strict Standardization of Benefits and Business Spending for Central SOE Managers	September 2014
	The Management system of state-owned assets	*Opinions on Reforming and Improving the Administrative System of State Assets*	October 2015
		Guiding Opinions on Structural Adjustments and Restruction of Central SOEs	July 2016
	Prevention of loss of state-owned assets	*Opinions on Improving the Supervision of State-Owned Assets of Enterprises and Preventing the Loss of State-Owned Assets*	June 2015
		Opinions on Establishing an Accountability System for Business Operations and Investment in Violation of Regulations by State-Owned Enterprises	August 2016
		Measures for the Supervision and Administration of the Transactions of State-Owned Assets of Enterprises	June 2016
		Measures for the Supervision and Administration of State-owned Equities of Listed Companies	July 2018
		Opinions on Strengthening and Improving the Work of Board of Supervisors in SOEs	September 2016
	The Party's leadership	*Opinions on Adhering to the Party's Leadership and Enhancing Party Development in the Process of Deepening SOE Reform*	June 2015
	Reform environment	*Summary of Policy Initiatives to Support SOE Reform and Relevant Opinions*	December 2015
		Work Plan for Accelerating the Separation of SOE-Run Social Functions and Resolving Legacy Issues	March 2016

	Others	*Summary of Policy Initiatives to Support SOE Reform and Relevant Opinions Work Plan for Implementing the Reform Initiatives of the CPC Central Committee and the State Council on Enhancing SOE Reform*	February 2016
		Implementing the Scheme of the CPC Central Committee and the State Council for the Division of Key Tasks for Implementing SOE Reform Guidelines	October 2015
		Scheme for the Pilot Programs of SOEs and Division of Work	December 2015

2. Establishment of Independent Director Systems by Listed Companies Guiding Opinion --- Issued by the China Securities Regulatory Commission on 16 August 2001

3. Independent Directors Must Be Independent

The following persons may not hold the position of Independent Director:

(1) Persons holding a position in the listed company or a subsidiary thereof and their lineal relatives and major social relations (the term "lineal relatives" meaning spouses, parents, children, etc.; and the term "major social relations" involving siblings, parents-in-law, children-in-law, siblings' spouses, spouse's siblings, etc.);

(2) Natural person shareholders who directly or indirectly hold not less than 1% of the issued shares of the listed company or who rank in the top ten shareholders of the listed company, and their lineal relatives;

(3) Persons who hold positions in entities that directly or indirectly hold not less than 5% of the issued shares of the listed company or that rank in the top five shareholders of the listed company, and their lineal relatives;

(4) Persons who, at some time in the previous year, have fallen into one of the three categories listed above;

(5) Persons who provide financial, legal, consultancy or other such services to the listed company or its subsidiaries;

(6) Other persons specified in the company's articles of association;

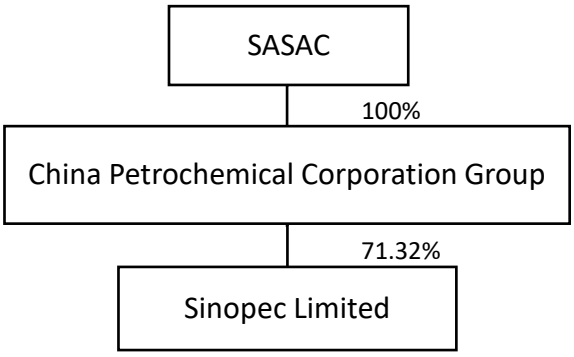
(7) Other persons determined by CSRC.

3. Example of affiliated directors and affiliated supervisors in listed CEs

Sinopec Limited (stock code = 600028) is a Chinese oil and gas enterprise. It is a listed CE, as SASAC solely owns its ultimate controller (China Petrochemical Corporation Group) for the State Council of the People's Republic of China. Sinopec Group has 71.32% ownership of its listed subsidiary. The translated excerpt from the 2016 Annual Report of Sinopec Limited and the ultimate control framework are shown below. In 2016, four directors on the corporate board of Sinopec Limited concurrently had a position in Sinopec Group. Therefore, those four directors are named as "affiliated directors". Also, two members on the supervisory board of Sinopec Limited concurrently had a position in Sinopec Group. Therefore, those two supervisors are named as "affiliated supervisors".

Board of directors	Position in Sinopec Limited	Position in Sinopec Group
Yupu Wang	Chairman	Chairman
Houliang Dai	Vice chairman, CEO	
Zhigang Wang	Director, Senior vice president (SVP)	
Haichao Zhang	Director, SVP	Vice CEO
Fangzheng Jiao	Director, SVP	Vice CEO
Yongsheng Ma	Director, SVP	Vice CEO
Xiaoming Jiang	Independent director	
Yi Yan	Independent director	
Min Tang	Independent director	
Gang Fan	Independent director	

Supervisory board	Position in Sinopec Limited	Position in Sinopec Group
Yun Liu	Chairman	
Zhongyun Liu	Supervisor	Assistant CEO, Head of HR
Hengyou Zhong	Supervisor	Office director of BOD
Huiping Zou	Supervisor	
Zhenying Jiang	Employee representative	
Renming Yu	Employee representative	
Yajun Wang	Employee representative	



4. Example of the separation of voting and cash-flow rights

Yunnan Copper Company Limited (stock code = 000878) is the third largest copper producer in China. It is a listed CE, as SASAC solely owns its ultimate controller (Aluminium Corporation of China) for the State Council of the People's Republic of China. The ultimate control framework from the 2016 Annual Report of Yunnan Copper Company Limited is shown below. In 2016, SASAC held 26.11% (58%×45.01%×100%) cash-flow rights and 45.01% voting rights of Yunnan Copper Company Limited, which shows that its cash-flow rights and voting rights diverge. The separation of voting and cash-flow rights is 1.72, when it is measured by the ratio of voting rights to cash-flow rights (45.01%/26.11%).